

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT				1. CONTRACT ID CODE		PAGE OF PAGES	
2. AMENDMENT/MODIFICATION NO.		3. EFFECTIVE DATE		4. REQUISITION/PURCHASE REQ. NO.		5. PROJECT NO. <i>(If applicable)</i>	
6. ISSUED BY		CODE		7. ADMINISTERED BY <i>(If other than Item 6)</i>		CODE	
8. NAME AND ADDRESS OF CONTRACTOR <i>(No., street, county, State and ZIP Code)</i>				(X)		9A. AMENDMENT OF SOLICITATION NO.	
						9B. DATED <i>(SEE ITEM 11)</i>	
						10A. MODIFICATION OF CONTRACT/ORDER NO.	
						10B. DATED <i>(SEE ITEM 11)</i>	
CODE		FACILITY CODE					

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

- ☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended. Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:
- (a) By completing items 8 and 15, and returning \_\_\_\_\_ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment your desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)*

13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS.  
IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

CHECK ONE	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: <i>(Specify authority)</i> THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES <i>(such as changes in paying office, appropriation date, etc.)</i> SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER <i>(Specify type of modification and authority)</i>

**E. IMPORTANT:** Contractor ☐ is not, ☐ is required to sign this document and return \_\_\_\_\_ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION *(Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER <i>(Type or print)</i>		16A. NAME AND TITLE OF CONTRACTING OFFICER <i>(Type or print)</i>	
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
<i>(Signature of person authorized to sign)</i>		<i>(Signature of Contracting Officer)</i>	

Item 14. Continued.

**CHANGES TO BIDDING REQUIREMENTS, PROJECT REQUIREMENTS, AND SPECIFICATIONS**

1. Replacement Sections. - Replace the following Section 01000 Parts with the accompanying new parts of the same number and title, each bearing the notation "ACCOMPANYING AMENDMENT #0005 TO SOLICIATION NO. DACA63-02-R-0017:"

01000	PART 9 – HOUSING UNIT DESIGN/CONSTRUCTION
01000	PART 10 – HOUSING UNIT STRUCTURAL DESIGN
01000	PART 13 – UNIT DESIGN - HVAC

END OF AMENDMENT

## **PART 9 – HOUSING UNIT DESIGN/CONSTRUCTION**

### **INDEX**

<b>9</b>	<b>HOUSING UNIT DESIGN / CONSTRUCTION.....</b>	<b>4</b>
9.1	GENERAL .....	4
9.1.1	Gross area definition .....	4
9.1.2	Net area definition .....	4
9.2	ACCESSIBILITY .....	5
9.3	FUNCTIONALITY .....	6
9.4	MAINTAINABILITY .....	6
9.5	FIRE PROTECTION AND SAFETY .....	6
9.5.1	Fire resistance of party walls and roof material .....	6
9.5.2	Mechanical rooms .....	7
9.5.3	Walls between garage and Housing units.....	7
9.5.4	Alarm systems .....	7
9.5.5	Secondary Means of Escape .....	7
9.6	SOUND ATTENUATION.....	7
9.6.1	External Noise Level Reduction Guidelines.....	7
9.6.1.1	Compliance for NLR 25.....	7
9.6.2	Sound attenuation at party walls .....	9
9.6.2.1	TESTING.....	9
9.6.3	Plumbing and HVAC equipment.....	10
9.7	DIMENSIONS AND AREAS .....	10
9.7.1	Minimum areas .....	10
9.7.1.1	Interior/Exterior Spaces .....	10
9.7.1.2	Kitchen Cabinets, Counters and Pantries .....	11
9.7.1.3	Closets.....	12
9.7.1.4	Bulk Storage.....	12
9.8	MAJOR ZONES .....	12
9.8.1	Living and Dining .....	12
9.8.2	Family Room.....	13
9.8.3	Bedrooms .....	13
9.9	MINOR ZONES .....	13
9.9.1	Bathrooms.....	13
9.9.1.1	Full Bath .....	14
9.9.1.2	Half Bath.....	14
9.9.1.3	Lavatories.....	14
9.9.1.4	Accessories .....	14
9.9.1.5	Exhaust Fans .....	14
9.9.2	Laundry Washer and Dryer.....	14
9.9.2.1	Cabinets .....	14
9.9.2.2	Door Clearance .....	14
9.9.3	Closets .....	15
9.9.3.1	Master Bedroom Closet.....	15
9.9.3.2	Closet Shelving .....	15
9.9.3.3	Closet Doors.....	15
9.9.4	Bulk Storage.....	15
9.9.5	Garages .....	15
9.9.5.1	Doors.....	16
9.9.5.2	Door Opener.....	16
9.9.6	Front Entry .....	16
9.9.6.1	Mailbox.....	16
9.9.6.2	Building Signage.....	16
9.10	INTERIOR FINISHES.....	16
9.10.1	Walls and ceilings.....	16

9.10.2	<i>Carpet</i> .....	17
9.10.3	<i>Resilient Flooring</i> .....	17
9.10.4	<i>Floor Base</i> .....	17
9.10.5	<i>Ceramic Tile</i> .....	17
9.10.5.1	<i>Bathtub Wainscot</i> .....	18
9.10.6	<i>Painting</i> .....	18
9.10.7	<i>Interior Finishes</i> .....	18
9.11	ROOFING AND DRAINAGE.....	20
9.11.1	<i>Roof Slope</i> .....	20
9.11.2	<i>Roof Trusses</i> .....	20
9.11.3	<i>Roof water</i> .....	20
9.11.4	<i>Roof surface</i> .....	20
9.12	EXTERIOR FINISHES.....	21
9.12.1	<i>Face Brick</i> .....	21
9.12.2	<i>{AM#0003} Deleted</i> .....	21
9.12.3	<i>Painting</i> .....	21
9.12.4	<i>Exterior soffits</i> .....	21
9.12.5	<i>Patios</i> .....	21
9.13	GLAZED OPENINGS.....	22
9.13.1	<i>Required tests</i> .....	22
9.13.1.1	<i>Structural Testing</i> .....	22
9.13.1.2	<i>Operating Force</i> .....	22
9.13.1.3	<i>Air Infiltration</i> .....	22
9.13.1.4	<i>Water penetration</i> .....	22
9.14	BUILDING THERMAL ENVELOPE.....	22
9.14.1.1	<i>U-Values and R-values</i> .....	22
9.14.1.2	<i>Thermal Insulation</i> .....	23
9.14.1.3	<i>Air Infiltration</i> .....	23
9.14.2	<i>Glazed doors</i> .....	23
9.15	WINDOW UNITS.....	23
9.15.1	<i>Aluminum Windows</i> .....	23
9.15.2	<i>Interior Window sills</i> .....	24
9.15.3	<i>Single-hung windows</i> .....	24
9.15.4	<i>Thermal Standards</i> .....	24
9.15.5	<i>Glazing</i> .....	24
9.15.6	<i>Tempered Safety Glass</i> .....	24
9.15.7	<i>Obscure Glass</i> .....	24
9.16	SCREENS.....	24
9.17	WINDOW TREATMENTS.....	24
9.18	DOORS.....	24
9.18.1	<i>Entrance doors</i> .....	25
9.18.2	<i>Storm doors</i> .....	25
9.18.3	<i>Mechanical and Storage Room Doors</i> .....	25
9.18.4	<i>Interior doors</i> .....	25
9.18.5	<i>Patio doors</i> .....	25
9.19	BUILDERS HARDWARE.....	25
9.19.1	<i>Locks and keys</i> .....	26
9.19.2	<i>Weatherstripping</i> .....	27
9.19.3	<i>Applications</i> .....	27
9.19.4	<i>Nameplate holders</i> .....	27
9.20	KITCHEN/BATH CABINETS.....	27
9.20.1	<i>Kitchens</i> .....	27
9.20.2	<i>Kitchen Cabinets</i> .....	27
9.20.3	<i>Storage and Countertop Requirements</i> .....	28
9.20.4	<i>Cabinet construction</i> .....	28
9.20.4.1	<i>Lumber Products</i> .....	28
9.20.4.2	<i>Sheet Materials</i> .....	28

9.20.5	<i>Countertops</i> .....	29
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## **9 HOUSING UNIT DESIGN / CONSTRUCTION**

### **9.1 GENERAL**

Unit design for square footage shall be within the ranges specified in Table 1-1. Increases in unit design above the maximum GSF or NSF are prohibited, except as noted below to accommodate accessible units.

#### **9.1.1 GROSS AREA DEFINITION**

Gross floor area includes all interior spaces (finished and unfinished) within the exterior faces of exterior walls and centerline of party walls (in duplex units) of housing units with the following exclusions:

- a) Garages.
- b) Exterior bulk storage.
- c) Trash enclosures.
- d) Porches, open or closed, which are not heated or cooled and which retain the basic characteristic of a porch.
- e) Terraces, patios, decks, balconies, and entrance stoops.

#### **9.1.2 NET AREA DEFINITION**

Net area is defined as the space inside the exterior and party walls. Net area excludes:

- a) Exterior and party walls.
- b) Half thickness of interior walls adjacent to excluded areas.
- c) Utility (Laundry) rooms.
- d) Interior and exterior bulk storage.
- e) Washer and dryer alcoves (not to exceed a combined 30 ft<sup>2</sup>).
- f) Mechanical room.
- g) Unfinished attic.
- h) Patios.
- i) Garages.
- j) Increases required to meet accessibility standards (not to exceed 75 ft<sup>2</sup>).
- k) Open or enclosed porches without heating, air conditioning, or interior-type finish.

## 9.2 ACCESSIBILITY

(a) Accessible Units. (See paragraph 1.2.3) Accessible units shall be designed in such a way that they may be easily and readily modified to accommodate physically challenged occupants, at time of occupancy. This means required door hardware, bathroom layout, kitchen layout, grab bars, plumbing hookups, light switches, outlets and controls do not need to meet requirements at the time of construction but must meet the requirements at time of occupancy. Also, requirements/replacements for cabinet heights, work surfaces, plumbing fixtures, and the warning devices for the hearing and visually impaired shall be made at time of occupancy. Revisions / replacements at the time of occupancy will be made by the Government. Net square footage limitations can be exceeded if necessary as noted in paragraph 9.1.2 (j), to accommodate disabled accessibility.

(b) A partial list of minimum accessibility measures to be included in the accessible units for this project are as follows (see UFAS 4.34 and ADA (Americans with Disabilities Act) for the complete requirements):

1. Provide minimum of one accessible (barrier free) entrance into accessible housing unit with walks and access to trash disposal and other housing exterior features, including parking.
2. All exterior doors shall be a minimum 3'-0" wide. Provide thresholds with a maximum height of 1/2-inch above adjacent surface at all exterior doors to housing unit.
3. Provide standard base and wall cabinets to be modified by the Government as the need arises. Adjust rough-in plumbing to accommodate future lowered sinks and lavatories.
4. Doors between all interior rooms including interior storage and utility shall be a minimum of 2'-10" wide.
5. Provide necessary blocking and reinforcing for the future installation of grab bars in appropriate locations, per the UFAS.
6. A full bathroom to provide barrier-free access, except that standard vanities shall be provided. Rough-in shall accommodate future barrier-free lavatories. The Government will replace items as the need arises.
7. Provide standard height toilet. The Government will provide handicap toilets as the need arises.
8. Bedroom closets shall have alternate cleats installed to provide barrier free heights for rod and shelf.
9. Sink and kitchen faucets shall be standard equipment, except that the faucets must have lever-type handles at the time of construction.
10. Standard range, dishwasher and other appliances shall be provided for all units. Space and kitchen layout shall accommodate future equipment complying with UFAS 4.34.6.6 and UFAS 4.34.6.8. The Government will replace items as the need arises.
11. Accessible spaces shall have maneuvering space complying with UFAS 4.2.2 and UFAS 4.2.3 and surfaces complying with UFAS 4.5 (with exceptions as noted herein).

### **9.3 FUNCTIONALITY**

Rooms shall be sized and arranged for efficient use, good circulation, and furniture placement. The distribution of space for food preparation living and dining, sleeping, bathing, halls, closets, and services should be balanced and should enhance the intended functions. See Appendix 7 for example floor plans of a 2-BR duplex, a 3-BR duplex and a 3-BR stand-alone housing unit. These example floor plans are provided for reference only and are not intended as mandated plans representing all required features. Example plans may not satisfy RFP requirements as set forth herein. Offeror is solely responsible for satisfying RFP requirements.

- a) Habitable rooms shall not be used as halls for entry into a housing unit or for primary circulation within a housing unit.
- b) Indoor and Outdoor Integration. Emphasize factors that enhance indoor and outdoor living. Consider size, layout and location of patios, balconies, yards, and features that encourage family use of outdoor areas.

### **9.4 MAINTAINABILITY**

The design of housing units including the selection and specification of exterior and interior finishes, equipment, appliances, and systems shall include consideration of maintenance ease and cost. Avoid products that require continuing maintenance at high cost.

### **9.5 FIRE PROTECTION AND SAFETY**

Housing units will comply with the applicable National Fire Codes, including NFPA 101, Life Safety Code and MIL HDBK 1008C. Construction features will be provided in accordance with the International Building Code (IBC) 2000 and the Air Force Family Housing Guide, Dec. 1995. Housing units in this project are not required to be sprinkled.

#### **9.5.1 FIRE RESISTANCE OF PARTY WALLS AND ROOF MATERIAL**

Party walls shall extend as a single UL design assembly, from ground to the underside of roof sheathing. Provide firestops at floor, and ceiling or roof line. Penetrations in a fire rated partition are to maintain the fire rated integrity assigned to that partition. Provide Class A (ASTM E108, Standard Methods of Fire Tests of Roof Coverings) roof covering material throughout. Party walls (walls separating housing units) shall have a minimum fire-resistance rating of {AM#0003}one (1) hour.



### **9.5.2 MECHANICAL ROOMS**

Rooms equipped with fuel-fired equipment such as a furnace and/or fuel-fired water heater shall serve only one housing unit and shall be lined with 5/8-inch Type X gypsum wallboard or equivalent noncombustible material. The mechanical room shall be located on an exterior wall and adjacent to the garage. The mechanical room space shall have a single door providing {AM#0005} tenant access from the exterior. A door between the garage interior and the mechanical room is prohibited. {AM#0003} The floor slab elevation of the mechanical room shall be the same elevation as the garage slab. The mechanical equipment room layouts shall be provided with ample floor space to allow for unobstructed access to accommodate routine servicing and maintenance of equipment and to have sufficient headroom to accommodate required equipment. Easy access to the furnace filter shall be provided. Contractor shall provide a floor drain in this room and slope floor slab to drain.

### **9.5.3 WALLS BETWEEN GARAGE AND HOUSING UNITS**

Provide UL designed one-hour fire rating extending from the ground to the underside of the roof sheathing, for walls between garage and housing units.

### **9.5.4 ALARM SYSTEMS**

Provide smoke alarms and carbon monoxide detectors within the housing unit that provide a local alarm only. See PART 14 of Section 01000 for specific alarm locations and additional requirements.

### **9.5.5 SECONDARY MEANS OF ESCAPE**

Every sleeping room and living area shall have a secondary means of egress in accordance with NFPA 101.

## **9.6 SOUND ATTENUATION**

### **9.6.1 EXTERNAL NOISE LEVEL REDUCTION GUIDELINES**

The limits of this project site fall within two separate noise zones (Compatible Use Zone). The western-most portion of the project site is within the 70-75 DNL noise contour (75 dB zone) while the remaining area is within the 65-70 DNL noise contour (70dB zone). See drawings provided with this RFP for noise zone delineation. Contractor must incorporate sound-reducing measures into the design and construction of the housing to achieve an outdoor to indoor noise level reduction (NLR) of at least 25 dB in the 65-70 DNL noise contour. Locating new housing units within the 70-75 DNL noise contour is prohibited.

#### **9.6.1.1 Compliance for NLR 25**

Compliance with the following standards shall be deemed to meet the requirements of the Compatible Use Zone in which an NLR 25 is specified.

##### **9.6.1.1.1 General**

- a) Brick veneer, exterior walls shall be constructed airtight. All joints shall be grouted or caulked airtight. Weep-holes with typical spacing are acceptable.
- b) At the penetration of exterior walls by pipes, ducts or conduits, the space between the wall and pipes, ducts or conduits shall be caulked or filled with mortar.
- c) Through-the-wall/door mailboxes shall not be used.

#### **9.6.1.1.2 Exterior Walls**

- a) Stud walls shall be at least 4 inches in nominal depth and shall be finished on the outside with brick veneer.
- b) Interior surface of the exterior walls shall be of gypsum wallboard 5/8-inch thick. The gypsum wallboard shall be fastened rigidly to the studs.
- c) Sheathing panels shall be butted tightly and covered on the exterior with overlapping building paper. The top and bottom edges of the sheathing shall be sealed.

#### **9.6.1.1.3 Windows**

- a) Windows other than as described in this section shall have a laboratory sound transmission class rating of at least STC-31.
- b) Windows shall be double-glazed and shall be a minimum of 1/8-inch thick (each pane) with a minimum 3/8-inch air gap.
- c) All operable windows shall be weather-stripped and air tight when closed so as to conform to an air infiltration test not to exceed 0.5 cubic feet per minute per foot of crack length in accordance with ASTM E283-65-T.
- d) The perimeter of window frames shall be sealed airtight to the exterior wall construction with a sealant conforming to any of the following Federal Specifications: TT-S-00227 (<http://astimage.daps.dla.mil/docimages/0000/58/72/51590.PD3>), with amendment (<http://astimage.daps.dla.mil/docimages/0000/58/72/51590.PD4>) or TT-S-00230 (<http://astimage.daps.dla.mil/docimages/0000/32/99/51593.PD2>), with amendment (<http://astimage.daps.dla.mil/docimages/0000/32/35/51593.PD9>).
- e) The total area of glass for the housing unit shall be greater than 10%, but shall not exceed 20% of the floor area.

#### **9.6.1.1.4 Doors**

- a) All exterior side-hinged doors, excluding patio door, shall be metal insulated doors with fibrous insulation and shall be fully weather-stripped. All doors shall be a minimum 1-3/4 inch thick throughout.
- b) The perimeter of all exterior door frames shall be sealed airtight to the exterior wall construction in accordance with TT-S-00227 or TT-S-00230.
- c) If any door contains glass, the glass shall be set and sealed in an airtight non-hardening sealant, or a soft elastomer jacket or glazing tape. Any door glazing in the front or side entrance doors shall not exceed 6 inches by 6 inches in size and shall be at least 3/16-inch thick.
- d) French type patio doors are required at the rear of the unit. See section 9.17 for requirements.

#### **9.6.1.1.5 Roofs**

- a) With an attic or rafter space at least 6 inches deep, and with a ceiling below, the roof shall consist of closely butted 5/8-inch thick plywood sheathing topped by roofing as required.
- b) Skylights are prohibited.

#### **9.6.1.1.6 Ceilings**

- a) Gypsum wallboard ceilings 5/8-inch thick shall be provided. Ceilings shall be substantially airtight, with a minimum number of penetrations.
- b) Glass fiber or mineral wool insulation shall be provided above the ceiling between joists, as required in Table 9-10.

#### 9.6.1.1.7 Ventilation

- a) The powered ventilator attic opening shall be fitted with sheet metal transfer ducts of at least 20 gauge steel, which shall be lined with 1 inch thick coated glass fiber, and shall be at least 5 feet long with one 90 degree bend. Soffit vents are required for air intake. Gabled roof vents, if provided, shall have baffles.
- b) All vent ducts connecting the interior space to the outdoors, excepting domestic range exhaust ducts, {AM#0005} bathroom exhaust ducts and dryer vents, shall contain at least a 10 foot length of internal sound absorbing duct lining. Each duct shall be provided with a lined 90-degree bend in the duct such that there is no direct line of sight through the duct from the venting cross section to the room opening cross section.
- c) Domestic range exhaust ducts connecting the interior space to the outdoors shall contain a baffle plate across the exterior termination to allow for proper ventilation. The dimensions of the baffle plate should extend at least one diameter beyond the line of sight into the vent duct. The baffle plate shall be of the same material and thickness as the vent duct material.
- d) Contractor shall minimize the number and size of openings in the attic.

#### 9.6.2 SOUND ATTENUATION AT PARTY WALLS

Party walls (walls separating adjacent housing units) shall be designed to provide the minimum airborne sound transmission ratings and impact isolation ratings stated in Table 9-1. Party wall shall be provided with 3-inch acoustical insulation woven between the studs and extending up to the top of the ceiling insulation. Penetrations shall be minimized and firestopped.

Table 9-1  
Sound Transmission Standards For Party Walls

Area	FSTC <sup>1</sup>
Party Walls (Housing Unit Separation)	56
{AM#0003}	-
{AM#0003}	-

NOTE 1: Field Sound Transmission Class. See ASTM E336.

#### 9.6.2.1 TESTING

Certified proof-of-performance field tests will be conducted to demonstrate that the party wall systems as constructed provide the required sound isolation. Tests for air-borne sound shall be made in compliance with ASTM E336. Tests for impact sound shall be made in compliance with ASTM E1007. Testing of 10 percent (minimum) of each type of party wall system is required. Location of test sites will be chosen at random by the Contracting Officer.

- a) Any party wall system found to be inadequate shall have the deficiencies corrected and the additional qualifying tests conducted at the Contractor's expense. Testing at the Contractor's expense of greater than 10 percent of each system may be required if the Contracting Officer determines that the quality of construction requires this additional testing.

- b) In cases where the field tested performance of the systems does not meet the designed performance, the maximum acceptable difference between field tests and sound transmission ratings shall be 2 decibels (dB) for airborne sound ratings and 5 dB for impact sound ratings.

### 9.6.3 PLUMBING AND HVAC EQUIPMENT

Design of plumbing and Heating, Ventilating and Air-Conditioning (HVAC) equipment shall include design provisions such as location, enclosure and acoustical treatment, to minimize transmission of noise generated by equipment within each housing unit and to eliminate transmission of noise to other housing units.

## 9.7 DIMENSIONS AND AREAS

### 9.7.1 MINIMUM AREAS

#### 9.7.1.1 Interior/Exterior Spaces

Minimum areas/dimensions for interior spaces are shown in Table 9-2. Minimum areas/dimensions for exterior spaces are shown in Table 9-3.

Table 9-2  
Minimum Areas and Dimensions – Interior Spaces

Space	Area	Length	Width/Depth	Height <sup>1</sup>
	ft <sup>2</sup>	ft-in	ft-in	ft-in
Living <sup>2</sup>	150	11-6	11-6	8-0
Dining (2/3 BR) <sup>2</sup>	100	9-0	9-0	8-0
Family Room <sup>2</sup>	100	9-0	9-0	8-0
Kitchen <sup>3,5</sup>	64	8-0	8-0	8-0
Eating Area in Kitchen <sup>4</sup>	72	8-6	8-6	8-0
Refrigerator	6	3-0	2-0	6-0
Washer alcove	11	3-2	3-2	7-0
Dryer alcove	11	3-2	3-2	7-0
BR #1	150	10-0	10-0	8-0
BR #2	130	10-0	10-0	8-0
BR #3	90	9-0	9-0	8-0
Full Bath <sup>5</sup>	40	8-0	5-0	8-0
Entry Hall	13	3-3	4-0	8-0
Hallways	-	-	3-0	8-0

NOTES:

1. Ceiling heights in habitable rooms shall be a minimum of 8 feet-0 inches. Ceiling heights can be reduced in parts of these rooms to 7 feet to accommodate ducts.
2. Room dimensions are exclusive of circulation. Circulation paths along one side of a room are permitted but add 3 feet-0 inches to the minimum dimension.
3. a minimum of 4 feet must be maintained in front of and between cabinets.
4. Minimum area and dimensions are measured from face of cabinets to walls.
5. Accessible units must conform to UFAS, which requires greater minimum dimensions.

Table 9-3  
Minimum Areas and Dimensions – Exterior Spaces

Spaces	Area	Length	Width/Depth	Height <sup>1</sup>
	ft <sup>2</sup>	ft-in	ft-in	ft-in
Garage	282	12-8	22-4	8-0
Patio - 2 BR	120	{AM#0003} <u>As required</u>	{AM#0003} <u>8-0</u>	8-0 (to underside of cover)
Patio - 3 BR	{AM#0003} <u>120</u>	{AM#0003} <u>As required</u>	{AM#0003} <u>8-0</u>	8-0 (to underside of cover)

#### 9.7.1.2 Kitchen Cabinets, Counters and Pantries

See Table 9-5. Flat area is shown for countertops and drawers. Combined vertical shelf area is shown for pantry and base, wall and wall cabinets. Minimum sized wall cabinet space required for tenant-furnished microwave is 16 inches x 27 inches. Shelf to support microwave shall be 17 inches deep. A door is not required for microwave shelf. All other kitchen cabinets shall be 12 inches deep as noted in Table 9-4.

Table 9-4  
Kitchen Cabinet, Counter & Pantry Area

Type of Housing Unit	Wall	Pantry/Base	Drawer	Counter
	ft <sup>2</sup>	Ft <sup>2</sup>	ft <sup>2</sup>	ft <sup>2</sup>
2 BR / 3 BR	24 / 28	24 / 28	12 / 14	18 / 20
Minimum Depth	12-inch	24-inch	24-inch	24-inch

### 9.7.1.3 Closets

Minimum closet width requirements are clear from the face of wall and stated in Table 9-5.

Table 9-5  
Minimum Closet Widths

Closet	2 BR Units	3 BR Units
	Ft-in	Ft-in
Coat/ Entry Hall	5-0	5-0
BR #1(Master)	6-0	8-0
BR #2	4-0	6-0
BR #3	3-0	4-0
Broom	3-0	3-0
Linen	2-0	4-0

### 9.7.1.4 Bulk Storage

Minimum and maximum requirements for interior, exterior bulk storage are shown in Table 9-6.

Table 9-6  
Bulk Storage

Type of Unit	Type of Storage	Minimum	Maximum
		ft <sup>2</sup>	ft <sup>2</sup>
2 BR	Int.	24	70
	Ext.	24	70
3 BR	Int.	24	80
	Ext.	24	80

## 9.8 MAJOR ZONES

### 9.8.1 LIVING AND DINING

The living room should have direct access to the front entrance vestibule and to the dining area without passing through another room. When circulation is required along the perimeter of the space or between areas in open plans, minimum circulation space of 3-feet 0-inches shall be added to the required minimum room dimension.

- a) The dining area may be an extension of, or an "L" off the living room.
- b) The dining area shall be directly accessible from the kitchen without passing through another room.
- c) The kitchen shall provide an efficient work triangle. A base cabinet, minimum 15 inches wide, shall be provided on the handle side of the refrigerator. The range shall not be located adjacent to the refrigerator, in a corner, adjacent to a passageway, or under or within 1 foot either side of a window opening. The dishwasher shall be installed adjacent to the kitchen sink. Provide a backsplash behind

the range, extending to the underside of the range hood, finished to match the countertop or range and the range hood.

- d) Provide auxiliary dining areas in the form of table space in the kitchen or in a family room adjacent to, or as an extension of the kitchen. The auxiliary dining area shall not be located in the living or dining rooms.
- e) In the kitchen, shoe molding (1/4 round) is required at all base cabinets where they meet the floor surface.
- f) A Pantry is a desired feature. Also see paragraph {AM#0003} 9.20.3 entitled “Storage and Countertop Requirements.”
- g) Fireplaces are prohibited in the housing units.
- h) The living room is required to have a future ceiling fan roughed-in with circuits for fan and light, wall mounted switches for fan and light and a properly braced {AM#0003} \_\_\_\_\_ mounting box {AM#0003} for ceiling fan.

### 9.8.2 FAMILY ROOM

Provide a separate family room, adjacent to and contiguous with the kitchen, for all three-bedroom units. A separate family room is desired, but not required for all two-bedroom units.

### 9.8.3 BEDROOMS

Bedrooms shall be designed to accommodate king-size beds in master bedrooms and double beds in the other bedrooms. Each bedroom shall have a clothes closet (see Table 9-5 for minimum sizes) with shelf provided. Each bedroom shall be accessible without passing through another bedroom. Design consideration shall be given to the movement of oversized furniture in and out of the bedrooms. Each bedroom shall be required to have a future ceiling fan roughed-in with circuits for fan and light, wall mounted switches for fan and light and a properly braced {AM#0003} \_\_\_\_\_ mounting box {AM#0003} for ceiling fan.

## 9.9 MINOR ZONES

### 9.9.1 BATHROOMS

Emphasis shall be placed on size, furnishings, layout, and privacy. Direct access to a bathroom from the master bedroom is required for three-bedroom units. Compartmented bath design, for family and guest use, is encouraged. Determine the minimum number of bathrooms based on Table 9-7. No bathroom features (sink and mirrors) are to be located in the master bedroom but shall be in the master bathroom. All full bathrooms shall have a wood linen closet with 12-inch minimum nominal depth shelves. See Table 9-5 for minimum width requirement.

Table 9-7  
Bathroom Requirements

Number of Bedrooms	Number of Full Bathrooms
2 BR	1
3 BR	2

#### **9.9.1.1 Full Bath**

A full bath shall contain a water closet, lavatory and a tub with shower assembly (Note: Tub with shower assemblies shall not be placed under windows). One full bath in each housing unit shall be directly accessible from a hallway without having to pass through another room. Tubs with shower assemblies shall include a shower rod. Sliding shower doors are prohibited.

#### **9.9.1.2 Half Bath**

A half bath is desired as a betterment (see Table 1-2) in 2-bedroom housing units, in addition to the minimum required bathrooms listed in Table 9-7. A half bath consists a lavatory and a water closet.

#### **9.9.1.3 Lavatories**

Provide lavatories mounted in 2-foot wide (minimum) countertops, with vanity bases. In master bedroom areas provide double sinks in bathrooms. Countertops shall be cultured marble with a minimum 4-inch high back splash. One-piece molded countertops/basins are not permitted. See paragraph 11.7 for lavatory requirements.

#### **9.9.1.4 Accessories**

Bathroom accessories may be surface mounted or recessed, of non-corrodible metal, and shall include towel bars totaling not less than 42 inches for a full bath and not less than 30 inches for a half bath. Accessories shall also include a mirror, toilet paper holder, 2 bathrobe hooks, and toothbrush and tumbler holder.

Medicine cabinets are not desired. Functionality of medicine cabinet will be provided by shelf space within required linen closet.

#### **9.9.1.5 Exhaust Fans**

Exhaust fans shall be switch operated separately from the lights and shall be ducted directly to the exterior of the building. See Part 13 for additional requirements.

### **9.9.2 LAUNDRY WASHER AND DRYER**

Laundry washer and dryer space shall be in a separate utility room for three-bedroom units. If utility room and interior storage are combined into one space, do not count this area in the calculation of NSF. In two-bedroom units, provide a separate non-enclosed space for the washer and a separate non-enclosed space for the dryer between the kitchen and the garage. These spaces (alcoves) for the washer and dryer shall face each other with an adequate circulation space between. Bi-folding doors are prohibited. Dryer vent shall vent through an exterior wall and shall not be visible from the street (see paragraph 13.7).

#### **9.9.2.1 Cabinets**

A cabinet with 12-inch minimum nominal depth shelves is required above the washer and the dryer. Cabinets shall be custom grade and painted or pre-finished.

#### **9.9.2.2 Door Clearance**

Minimum door width to utility room, when open, is 2 feet-8 inches, except within handicapped units where this width shall be increased to 3 feet. Swing door is preferred, but shall not conflict with operational space in front of washer/dryer appliances.



### 9.9.3 CLOSETS

Closets shall provide the minimum widths indicated in Table 9-5. A broom closet shall be provided convenient to the kitchen, and a coat closet shall be located in the entry hall.

#### 9.9.3.1 Master Bedroom Closet

A walk-in style clothes closet is preferred, but not required, in the master bedroom. The closet shall be provided with a door.

#### 9.9.3.2 Closet Shelving

Closets (except linen closets) shall be equipped with a single 12-inch deep shelf and a clothes hanger rod. Linen closets shall be provided with at least four full-depth shelves. Closet shelving and rods in excess of 4 feet shall have center supports. Shelves and supports shall be capable of carrying 35 lbs/ft. Closet shelving shall be minimum ¾-inch thick solid wood or plywood. Factory finished welded wire shelving is prohibited.

#### 9.9.3.3 Closet Doors

Closet doors should be located to permit placement of furniture in the corners of the rooms by providing an 18-inch return adjacent to a furnishable wall. Wall closet width shall not extend beyond either doorjamb more than 20 inches. All closet doors shall be hinge-type doors. Accordion, sliding and bi-fold doors are not permitted.

### 9.9.4 BULK STORAGE

Provide each housing unit with interior and exterior bulk storage space meeting the minimum requirements of Table 9-6. Provide interior storage in a separate room. Provide exterior {AM#0003} bulk storage in, or adjacent to, the garage. {AM#0003} Exterior bulk storage slab elevation shall be 4 inches above garage slab elevation. A separate storage area for the trash containers shall be provided in the garage, near the garage door. The trash container area shall be large enough to hold two standard garbage cans and one recycle container (18 inches wide by 26 inches long by 14 inches tall).

- a) Bulk storage space shall be at a minimum 4 feet in depth and a minimum clear height of 6 feet-6 inches.
- b) Provide a minimum of three nominally 12 inches deep shelves with a combined length of 24 feet within each bulk storage area (both exterior and interior).
- c) Common walls and ceilings between adjacent storage areas shall be finished on both sides.

### 9.9.5 GARAGES

Provide an attached single-car garage for each housing unit with 2 car option for all units per the Price and Proposal Schedule. Detached garages are prohibited. {AM#0003} A minimum of 80% of garages shall have side vehicle entry doors that do not face the street. {AM#0003} Garages facing the street are discouraged but will be allowed for a maximum of 17 living units to facilitate cul-de-sac layout, etc. Trash area in garage shall be in addition to the required car storage area. Refer to Table 9-3 in this section for garage minimum dimensions. Set the garage slab {AM#0003} and mechanical room slab elevations a minimum of 4 inches below the level of the finished floor for the living space. {AM#0003} \_\_\_\_\_. Slope slab to drain out the garage door. Garage shall have a 4-inch high, 3 ½ foot deep concrete tire bumper along the entire length of the interior back wall of the garage. This change in elevation can be provided by the 4-inch drop from finished floor elevation of the living space to the garage floor elevation.

Garages for ADA units shall have a cast-in-place concrete ramp from the living space to the garage finished floor elevation. Ramp shall not interfere with access to a parked vehicle in the garage (also see paragraph 9.2). The minimum required garage area stated in Table 9-3 may be increased for ADA units to accommodate circulation with ramp. The tire bumper is not mandatory in the garage of ADA units.

#### **9.9.5.1 Doors**

Garage doors shall be insulated with steel sandwich panel SDP-38 by Phoenix or approved equal, with pre-finished sides, 26-gauge embossed pebble-grained textured acrylic polyester coatings on exterior and hardware that can be opened and locked from inside and outside of the garage. Garage door shall be insulated to approximately R-8. Garage door shall not have windows.

#### **9.9.5.2 Door Opener**

Garage door shall be manually operated. Contractor shall provide a pre-wired electrical outlet at the ceiling for a future garage door opener. Also see Part 12 of this section for additional requirements..

### **9.9.6 FRONT ENTRY**

#### **9.9.6.1 Mailbox**

A mailbox shall be located on the exterior of the front entry of each housing unit. A through-door mailbox is prohibited.

#### **9.9.6.2 Building Signage**

Each housing unit will have a 3-digit number visible from the street, located near the front entry. See Paragraph 14.6.2. House numbers shall be 3-inch to 6-inch high numbers on a lighted fixture located in such a position as to be easily seen from the street. Signage house numbers shall be an energy efficient lighting with the following specifications: (a) Housing lens or diffuser - Thermoplastic, recognized component polycarbonates. (b) Frame sleeves - Thermoplastic recognized component ABS resin, U.V. stabilized. (c) Number plate translucent white thermoplastic recognized component polycarbonate U.V. stabilized. (d) Back plate – Pre-painted white steel A/S/1010/Thickness 0.0315. (e) Photocell - U-shaped mounting bracket which secures to back plate by a snap fit. (f) Socket assembly must be UL listed.

## **9.10 INTERIOR FINISHES**

### **9.10.1 WALLS AND CEILINGS**

Provide 5/8-inch, gypsum wallboard (gypsum board finish level #4) and light orange peel texture finish. Water-resistant wallboard shall be used in wet areas such as bath (as a minimum finish) and utility rooms. Interior finish shall have a flame-spread rating of 25 or less and a smoke-developed rating of 50 or less when tested in accordance with ASTM E84.

The color, texture and pattern selections for the finishes of the housing units shall provide a warm, comfortable, easily maintainable and functional environment for the occupants. Coordination of finish colors is necessary for a cohesive design. The design should include neutral colors that accommodate the varied occupant's furnishings. It is desirable for ceilings to be a lighter shade of white than the walls. Provide a painted wood base throughout the living areas of the housing units. Plastic laminates shall have patterns that are mottled, flecked or speckled with a mar-resistant finish, such as Formica's "Crystal" finish.

Ceiling heights higher than those specified in Table 9-2 for the kitchen, living room, family room and dining room are preferred.

All receptacle boxes and electrical switches prior to gypsum wallboard taping shall be masked to prevent gypsum wallboard cement from entering electrical boxes or touching sheathing on electrical sheathed cable.

Due to severe local problems with termite infestations, exterior and interior wall framing shall be treated wood or metal studs. See Part 10 for wall framing and sheathing requirements.

Garage ceiling and all exterior garage walls are not required to be insulated.

#### **9.10.2 CARPET**

Carpet shall meet the minimum requirements outlined in ETL 00-6 AIR FORCE CARPET STANDARD (<http://www.afcesa.af.mil/Publications/ETLs/ETL00-6Final.pdf>). Carpet color shall be neutral, such as beige or taupe, and patterns are to be avoided. Grey colored carpeting is prohibited. Carpet type shall be twisted loop and shall have a minimum 7-year limited warranty against soiling and liquid spills, and minimum 7-year wear warranty. Carpet fiber shall be 100% continuous filament nylon or 100% PET polyester. Primary backing shall be polypropylene. Minimum pile density rating shall be 4500 and minimum face weight shall be 28 ounces per cubic yard. Specify yarn that is branded by the fiber producer, 6 or Nylon-6 with a soil and stain resistant finish. Minimum gauge shall be 1/8. Provide 3/8-inch to 1/2-inch high-density polyurethane foam underlayment that meets HUD Use of Material Bulletin 72A HUD Building Product Standard and Certification Program for Carpet Cushion. Carpet must pass the Department of Commerce (DOC) FF 1-70 Pill Test (7 passes from 8 specimens) and the requirements of NFPA 101, The Life Safety Code. Carpet shall comply with 16 CFR 1630 and have a minimum average critical radiant flux of 0.45 watts per square centimeter when tested in accordance with ASTM E 648. Carpet shall be installed according to the manufacturer's instructions.

#### **9.10.3 RESILIENT FLOORING**

Vinyl composition tile (VCT) shall conform to ASTM F 1066, Class 2 (through pattern tile), Composition 1, asbestos-free. Tile shall have the color and pattern uniformly distributed throughout the thickness of the tile. VCT shall be provided as a minimum floor finish in main entry area, kitchen, bathrooms, washer/dryer alcove or utility room, and interior storage spaces, see Table 9-8. {AM#0003} Sheet vinyl is prohibited.

#### **9.10.4 FLOOR BASE**

Provide a painted wood (semi-gloss finish) base throughout the living areas of the house with carpet or VCT flooring. A stained base is prohibited. Where applicable, provide a ceramic tile base throughout the areas of the house with ceramic tile flooring.

#### **9.10.5 CERAMIC TILE**

Ceramic tile may be provided as a floor finish betterment in lieu of VCT, as indicated in Table 9-8. A mottled or speckled, glazed, 8 inch by 8 inch, ceramic floor tile shall be used. Ceramic tile shall conform to ANSI A137.1, moderate to heavy grade only. A medium to dark toned grout which coordinates with the floor tile is required to avoid a stained or soiled appearance. Grout shall be sealed.

Ceramic tile may be provided as a wall finish betterment in bathrooms, as indicated in Table 9-8. Provide ceramic wall tile patterns appropriate to room size and shape. Accent tile color shall be another neutral shade that coordinates with the dominant tile color.

#### **9.10.5.1 Bathtub Wainscot**

Provide a water impervious wainscot, to a minimum of 72 inches above finished floor, around all bathtubs and showers. Bath and shower wainscot shall be a 3-piece panel system. One-piece tub/shower/wainscot units are prohibited. If ceramic tile is provided in bathrooms, it shall not be used as a tub surround.

#### **9.10.6 PAINTING**

Finishes shall be lead free. Interior surfaces, except factory pre-finished material, shall be painted a minimum of one prime coat and two finish coats. Walls and ceilings in kitchen, baths and utility rooms shall be painted antique white or off-white. All trim shall be painted white.

#### **9.10.7 INTERIOR FINISHES**

- a) Carpet shall not be installed in kitchens, baths, utility rooms, washer/dryer alcoves or entry areas. Provide floor space at all exterior doors with VCT or ceramic tile finish.
- b) Concrete masonry is a prohibited interior finish.
- c) Vinyl wall covering or wallpaper is prohibited.
- d) Sprayed-on acoustical ceiling finish is prohibited.
- e) Wood floors are prohibited.
- f) Accents of stained woods, and built-in features, are prohibited.

Table 9-8  
Wall, Ceiling And Floor Finish Minimums And Betterments

Functional Area	Minimum Floor Finish	Desired Floor Finish (Betterment)	Minimum Wall Finish	Desired Wall Finish (Betterment)	Ceiling
Main Entry Hall	VCT (1)	Ceramic Tile	Textured & Painted Gypboard (5), (1)	N/A	Light texture (6)
Hall	Carpet (1)	N/A	Textured & Painted Gypboard (5), (1)	N/A	Light texture (6)
Kitchen (3)	VCT (1)	Ceramic Tile	Textured & Painted Gypboard (4), (1)	N/A	Light texture (5)
Living Room	Carpet (1)	N/A	Textured & Painted Gypboard (5), (1)	N/A	Light texture (6)
Family Room	Carpet (1)	N/A	Textured & Painted Gypboard (5), (1)	N/A	Light texture (6)
Bedrooms	Carpet (1)	N/A	Textured & Painted Gypboard (5), (1)	N/A	Light texture (6)
Bathroom (3)	VCT (1)	Ceramic Tile	Textured & Painted Gypboard (4), (1)	Ceramic Tile	Light texture (5)
Tub/Shower	N/A	N/A	3-piece panel system (4), (1)	N/A	Light texture (5)
Other Entry	VCT (1)	Ceramic Tile	Textured & Painted Gypboard (5), (1)	N/A	Light texture (6)
Washer & Dryer Alcoves (3)	VCT (1)	Ceramic Tile	Textured & Painted Gypboard (4), (1)	N/A	Light texture (5)
Utility Room (3)	VCT (1)	Ceramic Tile	Textured & Painted Gypboard (4), (1)	N/A	Light texture (5)
Garage	Concrete	None	Gypboard - Tape & Bed only (1)	Textured & Painted Gypboard (4)	Gypboard - Tape & Bed only
Mechanical Rm.	Concrete	None	Gypboard - Tape & Bed only (1)	N/A	Gypboard - Tape & Bed only
Interior Storage	VCT (1)	N/A	Textured & Painted Gypboard (4), (1)	N/A	Light texture (6)
Exterior Storage	Concrete	N/A	Gypboard - Tape & Bed only (1)	Textured & Painted Gypboard (4)	Gypboard - Tape & Bed only
Closets	(2)	N/A	Textured & Painted Gypboard (5), (1)	N/A	Light texture (6)
{AM#0003} Dining Room	{AM#0003} VCT (7) Carpet (8)	{AM#0003} Ceramic Tile N/A	{AM#0003} Textured & Painted Gypboard (5), (1)	{AM#0003} N/A	{AM#0003} Light texture (6)

**NOTES:**

- (1) Government will allow ONLY minimum or betterment if listed.  
(2) Match flooring finish in adjoining space.  
(3) Water resistant gypboard shall be used in kitchens, baths, utility rooms and washer/dryer alcoves  
(4) Paint finish is semi-gloss latex.

(5) Paint finish is satin.

(6) Paint finish is flat.

{AM#0003} (7) If Dining Room is separate from Family Room, VCT is minimum finish.

{AM#0003} (8) If Dining Room is a part of a great room concept, carpet is minimum finish.

## 9.11 ROOFING AND DRAINAGE

### 9.11.1 ROOF SLOPE

Provide roof slopes for all housing units including garages and covered patios as shown in Table 9-9. Provide approximately half the housing units with gable end roofs and half the housing units with hip roofs. Distribute the roof types randomly throughout the project site.

Table 9-9  
Roof Slopes

Roof Types	Rise	Run
3-Tab shingles with 25-year warranty	4 min., 5 max.	12

### 9.11.2 ROOF TRUSSES

Roof trusses shall be constructed of treated wood or steel members.

### 9.11.3 ROOF WATER

Gutters with leaf guards and downspouts shall be provided for all roof areas. Construction will be heavy wall, seamless aluminum (thickness = 0.032 inch). Roof water shall be diverted away from entrances. Prefabricated concrete splash blocks shall be provided under downspouts. Gutters and downspouts shall be factory finished to coordinate with building color and materials and shall be sized and designed in accordance with the SMACNA manual. Gutter support by spike and ferrules is not permitted. Attachment shall be by straps attached directly to the roof structure. Downspout extensions emptying onto concrete splash blocks shall be provided.

### 9.11.4 ROOF SURFACE

Roofing shall be limited to the following:

- a) Minimum of 3-tab shingles containing a 25-year product warranty. Contractor shall install shingles in strict accordance with the manufacturer's installation instructions. Contractor shall warrant roof system from leaks for a period of five (5) years.
- b) Roof sheathing to be 5/8-inch treated exterior grade plywood. Waferboard or pressed wood roof sheathing are not permitted.
- c) Contractor shall avoid the use of dark colors for roof surface. Lighter colors are desired for increased unit energy efficiency.
- d) Galvanized metal valleys are required as base bid. See Table 1-2 for betterment.
- e) Patios shall be covered and shingled.

- f) Parapet walls are prohibited.

## 9.12 EXTERIOR FINISHES

Emphasis shall be placed on low maintenance and durability for exterior finish materials. Materials shall be residential in size, scale, and texture. Exterior finish materials for garages will match the primary housing unit. Submit a minimum of 3 exterior color and finish schemes in the earth tones range for all the housing units. Each structure in turn should have a minimum of 3 colors, and a maximum of 4. The colors should be selected so that no two adjacent structures are colored alike, yet the selected colors of one should harmonize with its neighbors. For other exterior items, all building exterior corner trim, corbel and dentil trim, soffit and fascia, garage doors, window and garage head jamb and sill trim shall be painted, or pre-finished.

### 9.12.1 FACE BRICK

Brick shall conform to ASTM C216, Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale). Provide brick cap and flashing for all offset brick veneer. For grade beam design, the brick shall run a minimum of one course below the finished floor and shall be flashed at that level.

The housing units shall have a non-bearing brick masonry veneer. {AM#0003} All gabled-ends shall also have non-bearing brick masonry veneer. No other exterior cladding materials are acceptable. The Contractor will have the option to use either treated wood or a light-gauge metal stud wall system for the framing system. Contractor shall use 5/8-inch gypsum board sheathing and damp proofing for the exterior envelope. Provide termite shield at bottom of exterior walls. Also provide running bond pattern, joint reinforcement, wall ties, weeps, {AM#0003} \_\_\_\_\_ and concave mortar joints. {AM#0003} A vapor permeable weather-resistive barrier shall be installed on the exterior side of the sheathing in the cavity between the sheathing and the backside of the brick.

### 9.12.2 {AM#0003} DELETED

### 9.12.3 PAINTING

Exterior surfaces requiring painting shall be kept to a minimum, but where painting is absolutely necessary, exterior surfaces shall receive a minimum of one prime coat and two finish coats of paint. Wood trim frames, etc., shall be back primed.

### 9.12.4 EXTERIOR SOFFITS

Exposure of roof framing and underside of roof/floor decks are not permitted. Exterior wood materials that require field finishing are not permitted. {AM#0003} Roof soffits, patio soffits, roof edge trim, fascias, {AM#0003} \_\_\_\_\_, downspouts and gutters shall be factory color finished steel or aluminum. Exterior soffits shall be preformed and pre-finished metal with vented holes. Attic ventilation shall not be provided using only vented panels. A powered ventilator and vented panels shall be used together. See paragraph 13.9 for powered ventilator requirements. Vented panels shall be evenly spaced along the eaves. Cement asbestos ceilings or soffits are not permitted.

### 9.12.5 PATIOS

Patios shall be sloped to drain away from the residence and have a broom-finished concrete floor surface. Patios shall be covered and shingled. For all units, the patio slab shall be 4-inches below the finished floor elevation of the living space. For ADA units, a cast-in-place concrete ramp is required between the living space and the patio. The patio space lost due to the ramp shall be off-set by increasing the patio area for ADA units.

### 9.13 GLAZED OPENINGS

Windows and glazed door (50 percent or more glass) units shall meet the following standards and must be certified by an independent testing laboratory. In addition, windows must meet requirements of Section 9.6. Skylights are prohibited. The Contractor shall provide the manufacturer's certification that the windows/glazed doors provided meet the test requirements listed below.

#### 9.13.1 REQUIRED TESTS

Hung window units will meet a National Fenestration Rating Council (NFRC) design pressure rating of DP 25. Evidence of passing the following specific tests and minimum standards are required to achieve these design pressure standards.

##### 9.13.1.1 Structural Testing

Using ASTM E330 test results shall demonstrate no glass breakage, damage to hardware, or permanent deformation that would cause any malfunction or impair the operation of the unit. Residual deflection of any member shall not exceed 0.4 percent of its span. Hung windows shall be tested at pressures of 37.5 lb/ft<sup>2</sup>.

##### 9.13.1.2 Operating Force

The force necessary to unlatch and open window units shall not exceed 30 lb.

##### 9.13.1.3 Air Infiltration

Using ASTM E283 leakage rate shall not exceed 0.25 ft<sup>3</sup>/min/ft<sup>2</sup> at a test pressure of 1.57 lb/ft<sup>2</sup>.

##### 9.13.1.4 Water penetration

Using ASTM E547, no leakage shall be evident when tested in three, five-minute cycles with a one-minute rest period between cycles at 3.75 lb/ft<sup>2</sup>.

### 9.14 BUILDING THERMAL ENVELOPE

#### 9.14.1.1 U-Values and R-values

U-values and R-values shall comply with the Thermal Characteristics Requirements below in accordance with the standards set forth in TI{AM#0003}801-02 ([www.hnd.usace.army.mil/techinfo/ti.htm](http://www.hnd.usace.army.mil/techinfo/ti.htm)) and TM 5-785 / AFM 88-29 "Engineering Weather Data" ([www.usace.army.mil/inet/usace-docs/armymtm/](http://www.usace.army.mil/inet/usace-docs/armymtm/)). U-values shall be calculated using ASTM E1423 and NFRC 100-91.

Table 9-10  
Thermal Characteristic Requirements <sup>1,2</sup>

Weather Region	Wall <sup>3</sup> R-Value	Ceiling/Roof R-Value <sup>4</sup>	Door R-Value <sup>5</sup>	Glazed Openings U-Value <sup>6</sup>	
				Window	Door
11	13	38	5	0.50	0.38

NOTES:

1. R-values are in square foot-degrees F/BTUH. (R=1/U)



2. R-values listed represent the minimum acceptable insulation values for each construction type. Listed U-values represent the maximum thermal conductance allowed for windows and doors.
  3. Requirements for opaque exterior walls.
  4. For buildings with ventilated attics, no credit may be taken for the roof construction. R-value shall be computed for construction between conditioned space and ventilated attic or building exterior.
  5. Requirements for opaque doors in exterior walls (insulated metal).
  6. Window requirements for double pane, low-emissivity glass windows U-values as rated by the National Fenestration Rating Council (NFRC). Solar Heat Gain Coefficient shall be limited to 0.55.
- {AM#0003} 7. Unless noted otherwise all values in Table 9-10 are component values.

#### **9.14.1.2 Thermal Insulation.**

Thermal insulation shall have a flame-spread rating of 25 or less and a smoke-development rating of 50 or less, exclusive of the vapor barrier, when tested in accordance with ASTM E 84. A vapor barrier shall be provided on the warm-in-winter side of exterior wall and ceiling insulation. {AM#0003}\_\_\_\_\_.

#### **9.14.1.3 Air Infiltration**

{AM#0003}\_\_\_\_\_.

A blower door test, performed in accordance with ASTM E 779, Measuring Air Leakage by the Pressurization Method, shall be performed on {AM#0003} the prototype buildings. No other buildings require a blower door test.

Before beginning the test, all combustion devices shall be turned off, and all intentional openings in the building envelope (dryer vent, bathroom and kitchen exhaust, etc.) shall be sealed. All doors and windows shall be closed and latched.

To pass the blower door test, the building shall have an air tightness rating within the range of 3 to 4 ACH at 0.2 inch of water. The Contractor shall {AM#0003} \_\_\_\_\_ be responsible for all labor and materials required to reduce air leakage to within acceptable parameters. All testing shall be performed by a firm certified by the Associated Air Balance Council, the National Environment Balancing Bureau, and licensed by the State of Texas to perform such tests.

Any measures taken to reduce the air leakage to acceptable values shall be permanent, and shall be implemented on all similar housing units.

#### **9.14.2 GLAZED DOORS**

Glazed doors shall have insulated steel, or thermally broken aluminum frames conforming to the above requirements. Finish shall be factory applied and conform to 44-C-22431 in accordance with the requirements of the National Association of Architectural Metal Manufacturers (NAAMM) Metal Finishes Manual. Doors shall have interior operated latch, and securing pin or throw-bolt in frame.

### **9.15 WINDOW UNITS**

#### **9.15.1 ALUMINUM WINDOWS**

Aluminum windows shall be of standard stock dimension and design. Weather-stripping shall be factory applied. Windows shall conform to the requirements of ANSI Standard 302.9 - 1977 (latest edition) for the type specified

and shall include a vinyl thermal break. Window units shall be provided with an AA-C-22431 anodized finish in accordance with the requirements of the National Association of Architectural Metal Manufacturer's "Metal Finishes Manual". Color shall be dark bronze selected from the window manufacturer's standard colors.

#### **9.15.2 INTERIOR WINDOW SILLS**

Interior side of window sills shall be paint-grade, solid wood with minimum thickness of 3/4 inch. Stained/varnished wood is prohibited.

#### **9.15.3 SINGLE-HUNG WINDOWS**

Windows shall be single-hung {AM#0003}\_\_\_\_\_. Window sash shall operate vertically with the weight of the sash offset by a counterbalancing mechanism mounted in window to hold the sash stationary at any open position, and shall be complete with two locking devices to secure the sash in the closed position.

#### **9.15.4 THERMAL STANDARDS**

Aluminum windows and doors shall conform to AAMA 1504-83, "Thermal Performance of Residential Windows and Sliding Glass Doors". The perimeter of window frames shall be sealed airtight to the exterior wall construction with a sealant.

#### **9.15.5 GLAZING**

All door and window glazing shall be tinted, high efficiency, low E, double-glazed and insulated glass. Double-glazed window units shall be hermetically sealed. Provide a manufacturer's 10-year written warranty on the hermetic seal against condensation. See Section 9.6 for other glazing requirements.

#### **9.15.6 TEMPERED SAFETY GLASS**

Where glass extends to floor or to within 18 inches of floor, it shall be fully tempered safety glass.

#### **9.15.7 OBSCURE GLASS**

Provide double-glazed, patterned or obscure glazing for all bathroom windows.

#### **9.16 SCREENS**

Wire mesh fabric, aluminum screens and aluminum frames shall be provided at all operable sashes. Screens shall be black in color, shall be of window manufacturer's standard design, and shall conform to AAMA 1002.10, Voluntary Specification for Aluminum Insulating Storm Products for Windows and Sliding Doors.

#### **9.17 WINDOW TREATMENTS**

Provide 1-inch metal blinds at all windows. Color shall be coordinated with wall color.

Drapes or curtains are not permitted. Shades are not permitted.

#### **9.18 DOORS**

See Table 9-10 THERMAL CHARACTERISTIC REQUIREMENTS for thermal performance requirements for exterior doors. See paragraph 9.19 for Door Hardware.

### **9.18.1 ENTRANCE DOORS**

The housing unit primary entrance door and the door between garage and living units shall be 3 feet in width by 6 feet 8 inches in height by 1-3/4 inch thick, 16 gauge, metal with fibrous insulation, and decorative panel treatments embossed into both face sheets. Other housing unit entrance doors should meet this requirement but may be of lesser width. Primary entrance door shall have glazing provided not to exceed a 6-inch by 6-inch area. Metal doors shall conform to ASTM E 152, NFPA 252. The perimeter of exterior door frames shall be sealed airtight to the exterior wall construction with sealant. All exterior door frames to be painted hollow metal. Entrance doors shall meet the requirements specified herein, or as specified in Section 9.6 SOUND ATTENUATION, whichever is more stringent.

### **9.18.2 STORM DOORS**

An aluminum storm door shall be provided for all housing unit exterior hinged doors. The middle panel of the storm door shall have a multi-track system containing both a screen and a vertically sliding glass pane. Frames shall be a minimum of 1 inch thick and 5 inches wide aluminum clad with heavy-duty extruded aluminum. Screening materials shall be 18-inch x 18-inch aluminum mesh screen and black in color. All storm doors shall have closers provided.

### **9.18.3 MECHANICAL AND STORAGE ROOM DOORS**

Exterior bulk storage and mechanical room doors shall be a minimum of 3 feet in width by 6 feet 8 inches in height by 1-3/4 inches thick, 16 gauge, painted hollow metal flush type. Metal doors shall conform to ASTM E 152, NFPA 252. Mechanical room doors shall be insulated and weather-stripped.

### **9.18.4 INTERIOR DOORS**

Interior doors shall be hollow core, flush plain wood doors, 6 feet -8 inches in height by 1-3/8 inch thick. Wood doors and trim shall be painted. Door frames to be solid wood construction, paint grade. Closet doors shall be hinge type. Accordion, sliding and bi-fold doors are prohibited.

### **9.18.5 PATIO DOORS**

Patio doors shall be in-swinging, hinged, 36-inch wide, double doors with windows and muntins (French type) meeting the requirements of NWWDA I.S. 8. Patio Door and I.S. 2 Window Rating Grade 60. Patio doors shall be metal construction with a thermal break. Individual lites shall be glazed with 1/2-inch insulating glass units constructed of two panes of 1/8-inch tempered glass with a 1/4-inch air space. Glass shall be sealed in door and back bedded with bedding compound or glazing beads. Sliding glass doors will not be permitted. Wood molding shall be provided around the interior frame of the door and shall be painted. Blinds are not desired at patio doors.

## **9.19 BUILDERS HARDWARE**

Hinges, locks, and latches will comply with the specifications indicated in Table 9-11, and the following subparagraphs:

Table 9-11  
Hardware Specifications

Hardware Type/ Specification	Specific Requirements
Hinges ANSI/BHMA 101	Hinges shall be 4 inches x 4 inches at exterior doors, and 3-1/2 inches x 3-1/2 inches at interior doors. Hinges to be ball bearing type with a base material of brass or bronze, except as required for fire rated door.
Locks & Latches ANSI/BHMA A156.2	Series 4000, Grade 2, at exterior doors. Grade 2 at interior doors. Provide trim of wrought brass, aluminum, or stainless steel.
Auxiliary Locks ANSI/BHMA A156.5	Series 4000, Grade 2. Provide matching trim of wrought brass, aluminum, or stainless steel.
Interconnected Lock & Latches ANSI/BHMA A156.12	Grade 2. Provide matching trim of wrought brass, aluminum, or stainless steel.

### 9.19.1 LOCKS AND KEYS

Keys: Lock cores shall be removable type keyed in sets or subsets as scheduled. Lock cores shall be seven (7) pin. Cores shall be pinned for an A-3 (.018 differential) type system. Lock cores shall be keyed to existing base master keying system in sets or subsets in accordance with the approved schedule below. Dyess' existing master key system is by "BEST." Locks shall be furnished with the manufacturer's standard construction cores and key system. Permanent cores and keys including a typewritten key codes/biting schedule shall be sent by the lock manufacturer directly to Dyess Air Force Base by registered mail or other approved means. The address is:

7 CES/CEOL2  
Attn: Locksmith  
718 Third St  
Dyess AFB TX 79607-1618

Keys for locks shall be stamped with change number and the inscription "U.S. Property - Do Not Duplicate." Dyess uses a "K" and "L" type keyway. Keys shall be supplied as follows:

Locks:	2 change keys each lock
Master keyed sets:	6 keys each set
Construction keys:	6 total
Blank keys:	One per lockset provided
A3 Key kit:	1 kit for each 100 locksets (or fraction thereof)

The keys shall be furnished to the Contracting Officer arranged in a container specifically designed for key control system storage in sets or subsets as scheduled.

Keying Schedule: Before any hardware is delivered, a proposed keying system schedule shall be prepared and submitted to the Contracting Officer for approval. The lock manufacturer and/or their supplier must be furnished by the contractor with this project number, contract number, title, street address, and building number(s) before correct schedule can be developed. The base Locksmith shall be contacted (address above) to secure existing key codes/bitting if necessary to successfully master key new work under this contract.

Locksets and Latchsets: Locksets and latchsets shall meet ANSI/BHMA A156.2, Series 4000, Grade 2, bored type with roses. Handles/levers shall be provided on required handicapped accessible doors only. Locksets and latchsets shall be capable of accepting "BEST" removable cores. Other hardware manufacturers ("FALCON") have recently successfully demonstrated full capabilities of providing totally and completely interchangeable cores (round top/

unslotted) including pins, springs, etc, with Dyess' existing "BEST" system and can provide locksets and latchsets which accept same.

Contracting Officer shall provide master key codes to hardware manufacturer.

#### **9.19.2 WEATHERSTRIPPING**

Weatherstripping and exterior thresholds. Weatherstripping for heads and jambs of exterior doors shall be spring tension type, or cold rolled spring bronze, zinc, or other nonferrous metal. Vinyl magnetic weatherstripping is acceptable for metal doors. Exterior thresholds shall be nonferrous metal.

#### **9.19.3 APPLICATIONS**

Locks and hinges shall be applied as follows:

- a) Exterior hinged doors shall have 1-1/2 pair of hinges and a lockset. All exterior doors will also have a keyless dead bolt lock provided.
- b) Patio doors shall have 2 pair of hinges, a lockset and a pair of lever extension flush bolts top and bottom, with bottom bolt into dust proof strike at threshold.
- c) Each windowless entrance door will have a viewer mounted at eye level.
- d) Interior doors shall have 1-1/2 pair of hinges and latchset with ANSI/BHMA A156.2, F75 or F76 operations.
- e) Doors in fire-rated walls (from housing unit to garage) shall have 1-1/2 pair of steel ball-bearing hinges, lockset, auxiliary lock or interconnected lock and latch.

#### **9.19.4 NAMEPLATE HOLDERS**

Extruded aluminum nameplate holders shall be provided for each family housing unit. Size of nameplate holders shall be 1-3/4 inches by 26 inches and shall be slotted to receive existing plastic or metal letters inserted into the slot.

### **9.20 KITCHEN/BATH CABINETS**

#### **9.20.1 KITCHENS**

Kitchen design and layout shall be in accordance with the Air Force Family Housing Guide, Dec. 1995.

#### **9.20.2 KITCHEN CABINETS**

Kitchen cabinets shall be factory manufactured. Cabinets shall conform to the requirements of the Architectural Woodwork Institute (AWI) publication Architectural Woodwork Quality Standards, Guide Specifications & Quality Certification Program for "custom" grade kitchen and bathroom vanity cabinets, and the requirements of the National Kitchen Cabinet Association.

- a) The finished material of exposed fronts and ends of cabinets, door and drawer fronts shall be natural stained solid hardwood or hardwood veneer plywood with a durable maintenance free protective finish.
- b) Metal or plastic laminate cabinets will not be permitted.

- c) Raised panel cabinet doors are required.
- d) Top mounted center drawer guides will not be permitted.
- e) Cabinet catches shall be magnetic or hinges shall be spring loaded.
- f) In addition to the minimum requirements, accessories such as roll out trays, adjustable shelving, cutting boards and utensil dividers, etc., are desirable.
- g) Cabinets and countertops shall have a flame-spread rating that does not exceed 200 when tested in accordance with ASTM E84 and ASTM E162, Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
- h) Refer to Table 9-5 for minimum kitchen cabinet area requirements.

### **9.20.3 STORAGE AND COUNTERTOP REQUIREMENTS**

Kitchens shall meet the minimum storage/countertop areas required per Table 9-4. Proposers shall submit calculations in accordance with Figure 4-24 and Figure 4-25 within Chapter 4 of the Air Force Family Housing Guide. Kitchen cabinet layouts shall utilize all inside corners for storage. A "Lazy Susan" type revolving shelving shall be used at least in one corner. A 12-inch wide cabinet with a minimum of two vertical dividers to serve as a cookie sheet and pan holder shall also be included in the cabinet design.

In addition to the minimum requirements, pantries in or adjacent to the kitchen for storage or packaged food and housecleaning equipment and supplies are highly desirable.

### **9.20.4 CABINET CONSTRUCTION**

Frame members shall be mortised and tendoned, dove-tailed or doweled, and glued together. Brace the top and bottom corners with hardwood blocks that are glued with water-resistant glue and nailed in place. Wood cabinet materials and dimensions - Materials and minimum dimensions and thicknesses for cabinet construction materials shall comply with Table 9-12 and requirements below.

#### **9.20.4.1 Lumber Products**

- a) Softwood lumber: PS 20 custom grade, moisture content 6 percent.
- b) Hardwood lumber: PS 58, custom grade.

#### **9.20.4.2 Sheet Materials**

- a) Hardwood plywood: PS-51 custom grade; core material of particle board, rotary cut Natural Birch, grade "A" finished side and grade "3" for back ply material.
- b) Wood particleboard: composed of wood chips made with waterproof resin binders of 45 pound density sanded faces.
- c) Softwood plywood: PS 1, custom grade, core material of particleboard; species of Douglas Fir.

Table 9-12  
Kitchen Cabinet Specifications

Element Description	Specific Requirements
Frame Members	Per AWI.
Base Cabinet Toe Space	2-1/2 inches x 4 inches with 3/16-inch Oak face.
Cabinet Bottoms, Backs Ends, & Tops	Melamine finish over 3/4 inch plywood (except 1/4 inch plywood minimum at back). Brace bottoms with wood members glued in place.
Doors	Oak panel with oak face, stile and rail.
Drawer Slides/Guides	KV 1284 or approved equal solid stud acetyl roller, captive in one channel member, 100 pound/pair load capacity, side mounting, white color epoxy-coated cold rolled steel with positive stop. Lift-out disconnect "stay closed design".
Drawers	Oak face front. Conventional dovetail joint used to fasten side to back and front. All joints glued. All drawers and pull out shelves shall be mounted with side mounted slides.
Drawer Sides and Bottoms	Drawer sides shall be 1/2-inch thick plywood. Bottoms shall be 1/2-inch thick, spot-glued and set into members in grooves 1/4-inch deep with minimum 3/8-inch standing shoulder, fastened with glue blocks, except that at backs, it shall be glued and nailed to bottom edge at back.
Bumper Pads	Cork.
Shelves	3/4-inch industrial grade plywood with melamine top coat on both sides and hardwood edges. Steel supports of flush mounted angle with 1/4-inch diameter by 3/8-inch long on 2 inch centers. Shelf edges exposed to view shall be oak, rounded, filled, sanded, and finished.

### 9.20.5 COUNTERTOPS

Countertops shall be high pressure laminated plastic (0.043 inches for post formed tops and nominal thickness of 0.05 inches) with heat resistive adhesive, fully formed with a continuous sheet of plastic combining a no drip bull nose edge and an integral coved backsplash with a 4-inch minimum height. Backsplashes shall be provided at both back of counters and at side of counters where abutting a wall. The substrate for countertops shall be 3/4-inch thick particleboard.

## **PART 10 - HOUSING UNIT STRUCTURAL DESIGN**

### **INDEX**

<b>10</b>	<b>HOUSING UNIT STRUCTURAL DESIGN.....</b>	<b>3</b>
10.1	SECTION SUMMARY .....	3
10.2	REFERENCES .....	3
10.3	DESIGN .....	4
10.3.1	General.....	4
10.3.2	Dead Loads.....	4
10.3.3	Roof Live Loads .....	4
10.3.4	Floor Live Loads .....	4
10.3.5	Lateral Loads.....	5
10.3.5.1	Horizontal Loads (Acting Inward and Outward) .....	5
10.3.5.2	Seismic Loads.....	5
10.4	DESIGN CRITERIA .....	5
10.4.1	GENERAL.....	5
10.4.2	Minimum Footing Depth.....	5
10.4.3	Foundation Design .....	5
10.4.4	Roof Slope.....	6
10.4.5	Serviceability .....	6
10.4.5.1	Foundation Settlement Strength.....	6
10.4.5.2	Vertical Deflection of Suspended Horizontal Framing Members .....	6
10.4.5.3	Horizontal Deflection .....	6
10.4.5.4	Ultimate Strength of Structural Elements .....	6
10.4.6	Construction Tolerances.....	6
10.4.7	Durability .....	6
10.5	CONCRETE DESIGN .....	7
10.5.1	General.....	7
10.5.2	Testing .....	7
10.5.3	Forms.....	7
10.5.4	Reinforcing Materials.....	7
10.5.5	Concrete Materials .....	7
10.5.6	Vapor Barrier .....	7
10.5.7	Curing Compound .....	7
10.5.8	Ready-Mix Concrete .....	7
10.5.9	Foundation Systems.....	7
10.5.10	Conduits and Pipes .....	8
10.5.11	Slab Joints .....	8
10.6	MASONRY DESIGN .....	8
10.7	STEEL DESIGN .....	8
10.7.1	Structural Steel Design.....	8
10.7.2	Structural Cold Formed Steel Framing Design.....	9
10.7.3	Structural Vertical Wall Framing.....	9
10.7.4	Roof Trusses .....	9
10.8	WOOD .....	9
10.8.1	General.....	9
10.8.2	Structural Wood Design .....	10
10.8.3	Wood Treatment .....	10
10.9	SHEATHING .....	10
10.9.1	Roof Sheathing.....	10
10.9.2	Structural Wall Sheathing.....	10
10.9.3	Steel Strap Tension Bracing .....	10
10.10	CONSTRUCTION .....	10



10.10.1	<i>Foundation Walls</i> .....	11
10.10.2	<i>Slabs-On-Grade</i> .....	11
10.10.3	<i>{AM#0003} Deleted</i> .....	11

## **10 HOUSING UNIT STRUCTURAL DESIGN**

### **10.1 SECTION SUMMARY**

General: The structural criteria established herein shall be used for structural loading, design and installation of all structural systems and foundations, including manufacturing, erection, and supervision, testing, and quality assurance of the completed installation of the housing units. All structural calculations shall be checked and initialed as such by a registered structural engineer other than the original design engineer. Refer to the Foundation Design Analysis contained in the Preliminary Geotechnical Report as prepared by the Corps of Engineers for all foundation requirements and recommendations. The structural work generally consists of design, using the DESIGN LOADS and DESIGN CRITERIA below, and of construction of but not limited to:

- (1) Foundations.
- (2) Retaining Walls.
- (3) Load Bearing and Non-Load Bearing Walls.
- (4) Vertical Framing Members.
- (5) Horizontal Framing Members, including roof decks and diaphragms, roof beams and joists.
- (6) Interconnection Details including all fastening requirements.
- (7) Special Conditions, such as expansion, construction, and control joints, and changes in floor levels.
- (8) Appendix provisions for architectural, mechanical, and electrical elements.
- (9) Site fencing structure and foundations.

### **10.2 REFERENCES**

Design methods and stress allowances or load factors for the various structural materials shall be in accordance with the current editions of the codes and specifications listed in the table below. Recommendations made in the codes, specifications and industry standards in this paragraph are requirements of this RFP, unless specified otherwise in this RFP.

American Concrete Institute (ACI 318-02), Building Code Requirements for Reinforced Concrete.

American Concrete Institute (ACI 302), Guide for Concrete Floors and Slab Construction.

American Institute of Steel Construction (AISC), Manual of Steel Construction, Load and Resistance Factor Design

American Institute of Steel Construction (AISC), Design of Cold Formed Steel Structural Members, Latest Edition.

American Plywood Association, "APA Design/Construction Guide".

American Welding Society (AWS), Structural Welding Code

Federal Manufactured Housing Construction and Safety Act (FMHCSS)

International Building Code 2000 (IBC).

Southwestern Division, Design Criteria Architectural and Engineering Instructions Manual (AEIM), October 2000 (<http://www.swf.usace.army.mil/eandc/ec-a/2000aeim.html>)

Preliminary Geotechnical Report (see Appendix 1 of this RFP)

## 10.3 DESIGN

### 10.3.1 GENERAL

The overall structural system shall be selected based on durability, maintainability, and cost-effectiveness. {AM#0003} \_\_\_\_\_. The lateral support system shall be selected from conventional industry standard systems and shall be compatible with the vertical load carrying system. The design drawings shall contain in the General Notes a list of the design loading criteria, a list of the strengths of the engineering materials used, the design soil values and any other data that would be pertinent to remodeling and/or future additions. Structural calculations to substantiate the structural design shall be submitted in accordance with the requirements of Section 01330 CONSTRUCTION SUBMITTAL PROCEDURES.

### 10.3.2 DEAD LOADS

The structural system shall be designed and constructed to safely support all dead loads, permanent or temporary, including self weight, partitions, insulation, ceiling, floor covering, and all equipment that is fixed in position.

### 10.3.3 ROOF LIVE LOADS

Roofs shall be designed to support live loads, snow loads, including drifting snow, sliding snow, and rain on snow, and support wind loads including components and cladding in accordance with the IBC 2000 Edition. Snow loads, full or unbalanced, shall govern where such loading will result in larger members at connections. Other criteria is as follows:

- (1) Basic Wind Speed - 90 mph.
- (2) Minimum Roof Live Load - 20 psf.
- (3) Ground Snow Load - 5 psf.

If the design roof snow loading is less than 20 pounds per square foot, a minimum roof live loading for construction and maintenance of 20 pounds per square foot shall be used for design of the structure. This roof live loading is in lieu of and not in addition to the snow loading. However, unbalanced snow loads, sliding and drifting snow (in particular areas), or wind loads may be the controlling load case for particular elements.

### 10.3.4 FLOOR LIVE LOADS

Living Space	40 psf
Exterior Porches and Corridors	60 psf
Stairs (Concentrated Load)	300 lb
Uninhabitable Attics without storage	10 psf

### **10.3.5 LATERAL LOADS**

#### **10.3.5.1 Horizontal Loads (Acting Inward and Outward)**

The structural system wind design, including components and cladding, shall be designed in accordance with the {AM#0003} IBC 2000 based on the following criteria:

- (1) Basic Wind Speed - 90 mph.
- (2) Exposure "C".
- (3) Important Factor - 1.0.

#### **10.3.5.2 Seismic Loads**

Seismic design for this project will be in accordance with the ACC Seismic Design Criteria for New Construction Memorandum dated 9 September, 1998 (See Appendices). This document states that the 1997 Edition of the National Earthquake Hazard Reduction Program (NEHRP) establishes the new seismic design criteria for all new Air Force projects. Dyess AFB is located within Seismic Design Category A, per 1997 edition of NEHRP. As such, no specific seismic design requirements exist for these housing units.

## **10.4 DESIGN CRITERIA**

### **10.4.1 GENERAL**

The design drawings shall contain General Notes which shall contain a list of the design loading criteria, a list of the strengths of the engineering materials used, the design soil values, a fastening schedule, and any other data that would be pertinent to remodeling and/or future additions.

Walls mostly below grade that are supported laterally by diaphragms at or near the top and bottom, shall be designed using loadings based on at-rest soil pressures.

Freestanding earth retained walls shall be loaded with active soil pressure and surcharge loading if present, and with this loading the vertical resultant shall be in the middle 1/3 of the footing base width. For this design, factors of safety for overturning and sliding shall be at least 1.2. Retaining walls shall be constructed of reinforced concrete only. Weep holes shall be provided in the wall to eliminate saturated soil conditions behind the wall.

Diaphragms shall have continuous chord members on all edges and shall have direct positive connection for transferring load to all members of the main lateral force resisting system.

Sheetrock wall covering shall not be used as a lateral resisting element of the lateral design.

### **10.4.2 MINIMUM FOOTING DEPTH**

The minimum footing depth from bottom of footing to finish grade for frost penetration and/or earth cover shall be 18 inches unless noted otherwise.

### **10.4.3 FOUNDATION DESIGN**

The foundation system shall be as indicated in the Foundation Design Analysis as contained in the Preliminary Geotechnical Report (see Appendix 1).

#### **10.4.4 ROOF SLOPE**

See PART 9, Table 9-10 of Section 01000 for slope requirements.

#### **10.4.5 SERVICEABILITY**

##### **10.4.5.1 Foundation Settlement Strength**

An adequate level of protection against structural failure due to uniform and/or differential foundation settlement or general shear shall be provided.

##### **10.4.5.2 Vertical Deflection of Suspended Horizontal Framing Members**

Building serviceability shall not be impaired by vertical deflections. The sum of the instantaneous vertical deflections due to live load plus long-term sustained load deflections shall not exceed the span divided by:

- (1) 240 at roofs.
- (2) 600 at masonry lintels for masonry walls.

##### **10.4.5.3 Horizontal Deflection**

Horizontal deflection shall not exceed the limits set forth in the IBC 2000 Edition when the structure is subjected to the required seismic or wind loads.

##### **10.4.5.4 Ultimate Strength of Structural Elements**

An adequate level of protection against structural failure under extreme loads shall be provided. The proposer shall check the usual loading conditions for normal factors of safety and the extreme loading conditions, if present, for appropriate (unusual) factors of safety to provide levels of protection appropriate for the conditions.

#### **10.4.6 CONSTRUCTION TOLERANCES**

Allowable variations from level, or specific slopes, shall be as follows:

- (1) For overall length, or surface of 10 feet or less: plus or minus 1/8-inch.
- (2) Up to 20 feet: plus or minus 1/4-inch.
- (3) Up to 40 feet: plus or minus 3/8-inch.

#### **10.4.7 DURABILITY**

Structural components shall be protected from condensed moisture that could impair their structural adequacy through deterioration.

Special attention shall be given to protection for corrosion or oxidation of metals, decay of wood and wood base materials, spalling of concrete, leaching of mortar, and deterioration of adhesives. Prevention of these hazards shall be especially important.

The materials used in structural elements, components, and assemblies shall be resistant to or protected from damage by exposure to normal climatic conditions.

## **10.5 CONCRETE DESIGN**

### **10.5.1 GENERAL**

All concrete shall have a minimum compressive strength of 3000 psi at 28 days unless noted otherwise. All foundation walls and footings shall be constructed of reinforced cast-in-place concrete.

### **10.5.2 TESTING**

Testing of concrete work shall be done at the proposer's expense by an approved independent testing laboratory.

### **10.5.3 FORMS**

Materials for forms shall be plywood, metal, metal-framed, aluminum, reinforced fiberglass, or plywood-faced, to provide continuous, straight, smooth, exposed surfaces. Forms shall not be left in place.

### **10.5.4 REINFORCING MATERIALS**

Reinforcing Bars: ASTM A 615, minimum Grade 40, deformed.

### **10.5.5 CONCRETE MATERIALS**

- (1) Cement: ASTM C 150, Type I-II Portland cement low alkali (0.6% or less).
- (2) Fine Aggregate: ASTM C 33.
- (3) Coarse Aggregate: ASTM C 33.
- (4) Air-Entraining Admixture: ASTM C 260.
- (5) Flowing Concrete Admixture: ASTM C 1017, Type 1 or 2.
- (6) Calcium Chloride will not be permitted.
- (7) Fly Ash: ASTM C 618, Class "F"; fly ash content shall not exceed 20 percent of cement content or 100 pounds of fly ash per cubic yard of concrete, whichever is less.

### **10.5.6 VAPOR BARRIER**

Provide under all interior floor slabs. Polyethylene sheet not less than 6 mils thick. Provide 4-inch capillary water barrier under the vapor barrier.

### **10.5.7 CURING COMPOUND**

Liquid type membrane-forming curing compound complying with ASTM C 309, Type I, Class A or B.

### **10.5.8 READY-MIX CONCRETE**

Ready-mix concrete shall be in accordance with ASTM C 94.

### **10.5.9 FOUNDATION SYSTEMS**

The foundation system shall conform to the minimum requirements for a "Ribbed-Mat Slab" foundation system as specified in the Preliminary Geotechnical Report (See Appendix 1). {AM#0003}  
Conventionally reinforced foundations are required; post tension construction is not acceptable in this application. Also see Section 02364A of the RFP for termite protection requirements.

#### **10.5.10 CONDUITS AND PIPES**

Horizontal runs of conduits and pipes will not be embedded in foundation ribs and slabs supported by ground. Vertical penetrations will conform to ACI 318-02. Aluminum conduit and pipe shall not be embedded in any concrete structure.

#### **10.5.11 SLAB JOINTS**

Slab crack control joints may be construction joints, expansion joints, or weakened plane joints consisting of plastic insert "T" strips (minimum depth shall be 1/4 depth of slab thickness) placed in the fresh concrete. Saw cut joints will not be allowed. Reinforcement will be interrupted at (2 inches clear each side) crack control joints. Bars shall be located at mid-depth of the slab, and starting 2 inches from the edge of slab. The ends of crack control and corners of isolation joints will meet at a common point so far as practical. Stop reinforcing at expansion joints and provide smooth slip dowels (minimum 1/2-inch diameter) across the joint (dowels shall be ASTM A 615 material, plain bars).

When thickened slabs are employed under column bases or partitions, crack control joints parallel to the thickened slabs shall be offset from the thickened areas.

Walls, when used or required for lateral resistance to wind or earthquake, shall be founded on a full foundation.

Reentrant corners in slabs will be reinforced with a minimum of one No. 4 bar at 45 degrees to the corner.

### **10.6 MASONRY DESIGN**

Provide solid brick where cores in cored brick might be exposed.

Joints shall be 3/8-inch, tooled concave, Type "S" mortar.

Ties shall be corrugated galvanized steel, 22 gage minimum, length to extend to 3/4-inch from brick face. Space ties a maximum of 24 inches on centers vertically and 16 inches on center horizontally.

Installation of brickwork shall comply with the latest edition of the Brick Institute of America Technical Notes No. 28; Brick Veneer, New Construction.

### **10.7 STEEL DESIGN**

#### **10.7.1 STRUCTURAL STEEL DESIGN**

The detailing of structural steel framing, if used, shall be complete including connections. All weld types, weld sizes, bolt layouts, bolt sizes, connection plates, members sizes and locations, and stiffener plates sizes and locations shall be shown.

All members, elements, and connections that are a part of the main vertical and/or lateral force resisting system must be completely detailed.

{AM#0003}\_\_\_\_\_.

### **10.7.2 STRUCTURAL COLD FORMED STEEL FRAMING DESIGN**

Cold formed steel structural framing design shall comply with the American Institute of Steel Construction (AISC), Design of Cold Formed Steel Structural Members, Latest Edition, except as herein noted.

The detailing of cold formed steel structural framing, including connections, shall be complete. All welded connections, metal connectors, bolt layouts, bolt sizes, screw fastener patterns, and screw sizes shall be shown in details, notes and calculations. All members that are a part of the main vertical and lateral force resisting system must be completely detailed.

Walls, when used or required for lateral resistance to wind or seismic, shall be considered bearing walls.

### **10.7.3 STRUCTURAL VERTICAL WALL FRAMING**

Structural vertical (load bearing and non-load bearing) wall framing shall be no less than 3-1/2 inches wide, C-shaped, at 16 inches on center maximum spacing. Framing for all exterior walls shall be 18-gage thickness minimum, and framing for interior walls shall be 20-gage thickness minimum. Vertical studs which are attached to diagonal steel tension strap bracing shall have three horizontal rows of equally spaced solid blocking (blocking shall be the same size member as the vertical studs) between the studs for the horizontal distance of the brace. Double vertical wall studs shall be located under the point of connection of the diagonal brace to the top track of the wall. The bottom of the diagonal tension braces shall be attached with Phillips pan head self-tapping screws (number of screws shall be calculated) to a minimum 12 gage thick, L-shaped anchor plate which shall be anchored to the foundation system with a minimum of two 3/8-inch diameter anchor bolts. Wall framing shall be attached to the foundation with minimum 3/8-inch diameter washer on top of the bottom wall track at each anchor bolt. All vertical studs shall be attached with a minimum of one Phillips pan head self-tapping screw to each flange of the wall top and bottom runner tracks. Welding will not be permitted for material less than 18 gage thickness. Interior non-load bearing walls can be a minimum 3-1/2 inches wide, C-shaped, 25-gage minimum thickness at 16 inches on center maximum spacing.

### **10.7.4 ROOF TRUSSES**

Roof trusses shall be designed for the loads indicated. The truss diagonal members and top and bottom chords shall be custom rolled shapes, with a minimum 20-gage thickness, such that the truss is a concentric design. The end of the trusses for the overhang outriggers shall be a combination of metal stud units and the custom top chord unit. The design of trusses shall be integrated into the vertical and lateral load carrying systems. Truss member connections (chord and diagonal members) shall be fastened together with self-tapping screws sized for member axial loads and any eccentricity of the members.

{AM#0003}\_\_\_\_\_. {AM#0003} Truss system shall be designed in accordance with IBC 2000 and IRC 2000.

## **10.8 WOOD**

### **10.8.1 GENERAL**

Wood shall conform to the requirements of IBC 2000 and the following:



### **10.8.2 STRUCTURAL WOOD DESIGN**

The detailing of structural wood framing, if used, shall be complete including connections. All members, elements, and connections that are part of the main vertical and/or lateral force resisting system must be completely detailed. All metal connectors, bolt layouts, bolt sizes, nailing patterns and nail sizes shall be shown in details, notes and calculations. Staples shall not be used for the connections.

Wood stud spacing not to exceed 16 inches on center.

### **10.8.3 WOOD TREATMENT**

All wood shall be treated in accordance with American Wood Preservers Association, AWP, C-2 for above ground application. Wood that can come in physical contact with people such as decking and railing shall not contain arsenic based preservatives.

## **10.9 SHEATHING**

Wood sheathing design shall comply with the IBC 2000 Edition except herein noted.

Termite Protection: All wood used for sheathing shall be treated in accordance with American Wood Preservers Association, AWP, C- {AM#0005} 9 for above ground application. See Section 02364A of the RFP for additional termite protection requirements.

The detailing of wood sheathing, including connections, shall be complete. All metal connectors, bolt layouts, bolt sizes, nailing patterns and nail sizes shall be shown in details, notes and calculations. Staples shall not be used for the connections. All members that are a part of the lateral force resisting system must be completely detailed.

### **10.9.1 ROOF SHEATHING**

Roof sheathing shall be plywood APA RATED STRUCTURAL I or II SHEATHING, 5/8-inch minimum thickness. Joints shall be tongue and grooved or be square edges provide with H clips. All roof sheathing laid shall be covered with felt by the end of each day or when a storm is approaching. Roof sheathing damaged due to moisture shall be replaced.

### **10.9.2 STRUCTURAL WALL SHEATHING**

Wood structural panels, if used, shall be as defined by IBC 2000 Edition. Particle board and fiberboard shall not be used in structural applications.

### **10.9.3 STEEL STRAP TENSION BRACING**

Straps shall be a minimum 14 gage thickness by a minimum 2 inches wide. Straps shall be fastened to flange of each intersecting vertical wall stud, to the wall top runner track flange and to the metal plate anchor at the bottom of the walls with Phillips pan head self-tapping screws. Calculations shall be provided for the design of the size and number of the screw fasteners.

## **10.10 CONSTRUCTION**

#### **10.10.1 FOUNDATION WALLS**

Foundation wall shall be constructed of reinforced concrete or masonry.

Foundations walls shall extend at least 8 inches above finish grade.

Foundation walls supporting basements shall have a foundation drainage system installed around the foundation perimeter in accordance with IBC 2000.

#### **10.10.2 SLABS-ON-GRADE**

Concrete slabs-on-grade shall be {AM#0003}\_\_\_\_\_ designed as a monolithic ribbed mat slab for bidding purposes. See Preliminary Geotechnical Report in Appendices for additional details. Bond breaker, such as building felt, shall be used between slab edges and abutting vertical surfaces.

Slabs shall be damproofed in accordance with IBC 2000.

{AM#0003}\_\_\_\_\_.

Crack control measures shall be incorporated into slab construction. Area of sections bounded by crack control joints shall be approximately square shall not exceed 225 square feet, and distance between crack control joints will not exceed 15 feet. All slab crack control joints, joints between edges of slabs and vertical surfaces, and any mechanical, plumbing or electrical penetrations through the floor slab shall be sealed with a flowable polyurethane caulk. Interior slabs shall be given a steel troweled finish.

#### **10.10.3 {AM#0003} DELETED**

## **PART 13 - UNIT DESIGN - HVAC**

### **INDEX**

<b>13</b>	<b>UNIT DESIGN - HVAC .....</b>	<b>2</b>
13.1	HVAC DESIGN .....	2
13.1.1	Load calculations .....	2
13.1.2	Duct system layout.....	3
13.2	EQUIPMENT SAFETY AND EFFICIENCY.....	3
13.2.1	Equipment.....	3
13.2.2	Efficiency .....	4
13.3	HEATING AND COOLING SYSTEMS .....	4
13.3.1	Mechanical Room .....	4
13.3.2	Forced warm air systems.....	5
13.3.3	Split system air conditioning .....	5
13.3.3.1	Equipment.....	5
13.3.3.2	Evaporator Coil.....	5
13.3.3.3	Condensing Unit .....	6
13.3.3.4	Refrigerant Charge Verification.....	6
13.3.4	Unacceptable systems.....	6
13.4	AIR DISTRIBUTION .....	6
13.4.1	Supply diffusers.....	6
13.4.2	Return and exhaust grilles.....	6
13.4.3	Ductwork .....	7
13.4.4	Filtration.....	7
13.5	THERMOSTATS .....	7
13.6	EXHAUST FANS .....	7
13.7	DRYER VENTS .....	8
13.8	PIPING REQUIREMENTS .....	8
13.9	ATTIC VENTILATORS.....	8
13.10	ENERGY USE BUDGET (EUB).....	8
13.11	TESTING, ADJUSTING, AND BALANCING .....	8

## 13 UNIT DESIGN - HVAC

### 13.1 HVAC DESIGN

Heat gain and loss calculations shall be, as a minimum, in accordance with the current edition of the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals. The cooling load calculations shall be in accordance with ASHRAE Residential Cooling Load Calculations. Computer-generated load calculations shall be provided at design submittals after contract award, and shall include complete input and output summaries (see Section 01012 SUBMITTALS DURING DESIGN). Design shall be based on the weather data shown in Table 13-1. Air-cooled condenser shall be selected to meet the calculated cooling load at an ambient temperature of 98 degrees F.

Table 13-1  
Weather Data

Type of Design / Design Information	
Weather Region 11	
<b>Heating</b>	
Indoor Design Temperature	70 degrees F
Outdoor Design Temperature	19 degrees F
Annual Heating Degree <sup>1</sup> Days	2,682
<b>Cooling</b>	
Indoor Design Temperature	75 degrees F
Outdoor Design Dry Bulb Temperature	98 degrees F
Outdoor Design Wet Bulb Temperature	71 degrees F
Annual Cooling Degree Days	2,466

Note<sup>1</sup>: Data is based on degree-days Fahrenheit to a base of 65 degrees F.

#### 13.1.1 LOAD CALCULATIONS

Computer generated load calculations shall be performed for each possible orientation up to four representative orientations for each building type included in the project and provided at design submittals after contract award (see Section 01012 SUBMITTALS DURING DESIGN). Room airflow requirements shall be computed based on the individual room load. However, the minimum acceptable airflow shall be 0.5 cfm/ft<sup>2</sup> for all spaces. Load calculations shall include a 10% safety factor for cooling and a 30% safety factor for heating. Natural infiltration rates of 0.35 AC/hr shall be an acceptable value for calculations. The design for each individual housing unit shall be based on the heating and cooling loads as well as room

airflow requirements computed for the building type and orientation, which it most closely matches. Heating load calculations shall be made without regards for people, lights, equipment, solar wall, roof gains or passive solar gains. Table 13-2 below identifies the internal loads, which shall be included in the computerized cooling load calculations in accordance with ASHRAE recommendations for residential analyses.

**TABLE 13-2  
INTERNAL HEATING AND COOLING LOADS**

INTERNAL LOAD DESCRIPTION		ANTICIPATED INTERNAL LOADS
Occupancy	2BR	4 Persons
	3BR	5 Persons
Hours of Use		24 Hours/Day
Additional Sensible and Latent Loads		Kitchen and Laundry Room: 3200 BTUH (Sensible: 200 BTUH, Latent: 3000 BTUH)
Hours of Use		6 Hours/Day
Maximum Overhead Lighting Level		3.41 BTUH/Sq. Ft.
Maximum Task Lighting Level		682 BTUH

### **13.1.2 DUCT SYSTEM LAYOUT**

For a given building type, a single duct layout may be used regardless of orientation, provided that the system is sized to provide the required airflow for each room at its worst-case orientation. All ductwork shall be above finished floor. Balancing dampers shall then be used to reduce airflow to the appropriate level as required. Permanent access to dampers shall be provided.

## **13.2 EQUIPMENT SAFETY AND EFFICIENCY**

All materials and equipment shall be the standard cataloged product of manufacturer's regularly engaged in production of such materials and equipment, and shall be the manufacturer's latest standard design. Each major component of the heating and cooling system shall have the manufacturer's information on a plate secured to the equipment.

### **13.2.1 EQUIPMENT**

Equipment shall comply with the requirements of American Gas Association (AGA), American National Standards Institute (ANSI), Air Conditioning and Refrigeration Institute (ARI), American Society for Testing and Materials (ASTM), Gas Appliance Manufacturers Association (GAMA), National Electric Manufacturers Association (NEMA), National Fire Protection Association (NFPA), Underwriters Laboratories, Inc. (UL) Uniform Mechanical Code, ASHRAE 90.2P or other national trade associations as applicable.

**13.2.2 EFFICIENCY**

Equipment efficiencies as listed in Table 13-3 are minimum acceptable levels. Energy conservation as it relates to equipment operating costs will be considered in the evaluation process. Additional consideration in the technical evaluation will be given to designs, which include higher than minimum efficiency equipment.

Table 13-3  
Minimum Equipment Efficiencies

	Natural Gas fired equip	Electric cooling equip
Furnace AFUE	80% minimum	N/A
SEER	N/A	12

**13.3 HEATING AND COOLING SYSTEMS**

Each housing unit shall be provided with central heating and air conditioning system. Air conditioning system shall be sized to meet the total load determined by computer calculations and matched to the furnace airflow capacities. Supply and return duct distribution systems shall be designed, installed, balanced, and adjusted to distribute heat and cooling to all habitable rooms, as well as bathrooms and to entry vestibule, in proportion to the calculated load requirements of these spaces. Fans in air handlers and furnaces shall be multi-speed, direct drive type. System installation shall conform to SMACNA Installation Standards for Residential Heating and Air Conditioning Systems except as altered by this document. Additional consideration in the technical evaluation will be given to systems utilizing modular components, plugged power, drawer-type burner assemblies, additional space in the mechanical room, and other features which contribute to ease of system maintenance. Additional consideration will also be given to designs which provide measures beyond the requirements of this Section to increase energy conservation and/or occupant comfort.

**13.3.1 MECHANICAL ROOM**

A mechanical room shall be provided to house all mechanical equipment. Shared common mechanical rooms are prohibited in duplex buildings. Exterior air conditioning units shall be pad-mounted, located on the side or in the rear of the housing units. Effort shall be made to locate the unit(s) out of the occupant's direct line of sight (i.e. screen with shrubbery or wall, locate on sides of housing unit, avoid placement under windows, etc.), as well as out of direct, afternoon sunlight. However, the primary concern shall be coordination with the mechanical room location. Do not locate air conditioning condenser units within 10 feet of a dryer vent. Mechanical equipment (i.e. furnace and hot water heater) shall be located in the mechanical room and arranged to allow for ease of maintenance, and for proper venting. This room shall be provided with a ceiling mounted light controlled by a wall-mounted switch. This room will also be provided with a standard 120V receptacle. Provisions for installation, removal, and future replacement of equipment shall be coordinated with the architectural design. Exposed piping and equipment is allowed in the mechanical room.

### 13.3.2 FORCED WARM AIR SYSTEMS

Warm air furnaces shall be induced combustion, upflow natural gas furnaces. Furnaces shall be equipped with electronic pilotless ignition. Natural gas furnaces shall be equipped with a flue to exhaust flue gases above the building roof. Units shall be vented in accordance with NFPA 211. Roof flue vent shall be located back-slope of the roof so as not to be visible from the front of the housing unit. Combustion air shall be provided from the outside in accordance with UMC or model codes. Combustion air shall be provided in accordance with SMACNA Installation Standards for Residential Systems. Furnaces shall be equipped with centrifugal fan, disposable {AM#0005} panel filter (filter shall be {AM#0005} located at the furnace and shall be easily accessible to the occupants), controls, and transformer. Fans shall be multi-speed, direct-drive type. It shall be possible to service and replace all controls and internal components from one side of the furnace. Heat exchangers shall be guaranteed for a minimum service life of 20 years. Furnaces shall be equipped with a cooling coil by the same manufacturer, matched to the selected air conditioning equipment.

### 13.3.3 SPLIT SYSTEM AIR CONDITIONING

#### 13.3.3.1 Equipment

Electric air conditioning equipment shall consist of an air-cooled condensing unit and evaporator as matched components with the furnace, all by the same manufacturer, all with a manufacturer's 10-year extended warranty. Refrigerants used shall have an Ozone Depletion Potential (ODP) less than 0.05. The condensing unit shall contain, as a minimum, the features indicated in Table 13-4. Equipment shall be sized to meet the total load determined by computer calculation. Equipment may be oversized to no more than 125 percent of the computer generated load. Fans shall be multi-speed, direct drive type.

TABLE 13-4  
SPLIT SYSTEM AIR CONDITIONING FEATURES

High and low pressure compressor protection.
Filter-drier.
Hermetically sealed compressor with built-in overloads and locked rotor protection.
Electric crankcase heaters.
Start and Run Capacitors
Anti-short-cycle timer. (factory installed)
Testing and charging refrigerant connections.
Compressor guaranteed for a minimum service life of 10 years.
Fan and coil (hail) guards.

#### 13.3.3.2 Evaporator Coil

The evaporator coil shall be provided with a liquid strainer, expansion device, pre-insulated housing, copper coil, and insulated condensate drain pan. Coil face velocity shall be limited to 550 fpm. Condensate drain lines shall be one size larger than the drain pan connection, be properly trapped, and indirectly piped to a floor drain. Refrigerant lines running between the condensing unit and the evaporator shall be concealed, except in the mechanical room.

### 13.3.3.3 Condensing Unit

The condensing unit and matched coil shall deliver a Seasonal Energy Efficiency Rating (SEER), consistent with the minimum requirements shown in Table 13-3. The condensing unit shall be installed in accordance with the manufacturer's recommendations.

### 13.3.3.4 Refrigerant Charge Verification

When split-system air conditioning systems are selected for installation, the contractor shall check, calibrate, and charge the refrigerant system following installation and startup of the equipment. These tests shall be accomplished on the same 10% of the units which undergo blower door and duct tightness testing. If the tested units show a low or excessive refrigerant charge, all new systems shall be checked after startup, but prior to acceptance by the Government.

### 13.3.4 UNACCEPTABLE SYSTEMS

Room unit heaters, space heaters, room (window) or through-the-wall air conditioning units, floor furnaces, gravity warm air systems, evaporative coolers, heat pumps, and electric resistance heaters are not permitted. Also, crawl space or downflow furnaces are unacceptable systems.

## 13.4 AIR DISTRIBUTION

Provide systems conforming to the recommendations of the ASHRAE Air Distribution Manual. The air distribution system shall be designed to provide a maximum air transport factor of 5.5 when calculated as follows:

Air Transport Factor = (Space Sensible Heat Removal)/(Supply fan Power Input + Return Fan(s) Power Input) where the heat removal in above and power input are measured in watts [Btu/h].

Provide outdoor air in accordance with ASHRAE 62-1999. {AM#0005} Infiltration and natural ventilation can be assumed to provide the minimum required outside air changes per hour.

### 13.4.1 SUPPLY DIFFUSERS

Wall and/or ceiling supply diffusers shall be located to ensure that the air distribution will completely cover all surfaces of exterior walls with a blanket of conditioned air. At least one diffuser shall be provided in each habitable room. Diffusers shall be lever operated resident accessible, have louvered faces with individually adjustable blades, and shall be provided with integral opposed blade damper. Diffusers shall be provided with air deflectors as required for proper airflow in the space. Plastic diffusers are prohibited. Core velocity shall be limited to 600 fpm maximum, with a maximum pressure drop of 0.1-inch water. Airflow from any single diffuser shall be limited to 200 cfm maximum. Ceiling mounted units shall have factory finish to match ceiling color, and be installed with rims tight against ceiling. Sponge-rubber gaskets shall be provided between ceiling or wall and surface-mounted diffusers for air leakage control. Suitable trim shall be provided for flush-mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Wall supply registers shall be installed at least 6 inches below the ceiling.

### 13.4.2 RETURN AND EXHAUST GRILLES

Grilles shall be fixed horizontal or vertical louver type similar in appearance to the supply diffuser face. Plastic units are prohibited. {AM#0005} Filters within return grilles are prohibited. Core velocity shall be limited to 400 fpm maximum, with a maximum pressure drop of 0.06-inch water. Grilles shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Wall return grilles shall be located at least 6



inches above the floor. Return grilles shall be located in hallways or other normally unoccupied spaces to minimize the sound level in occupied spaces.

### 13.4.3 DUCTWORK

Supply and return ductwork shall be externally insulated sheet metal: no fiberboard or flexible metal is allowed. {AM#0005} Pre-insulated flexible ductwork, not to exceed 6 feet in length, is permitted to make connections to the registers. Insulate ductwork located in unconditioned spaces and unheated mechanical rooms. Sub-slab and intra-slab ductwork is also prohibited. Volume dampers shall be provided at each branch take-off. All ductwork shall be concealed. Permanent access to dampers shall be provided. No portion of the building construction (i.e. joist space in a floor or ceiling, wall stud space, etc.) shall be used as a duct. Exhaust fan ductwork shall be externally insulated.

- a) Maximum velocity in supply ducts shall be limited to 900 fpm for mains and 600 fpm for branches.
- b) Ducts shall be airtight with no visible or audible leaks to ensure quiet, economical system performance. Ductwork in conditioned spaces shall be constructed for a 1 inch static pressure construction class with seal class C, as described in the SMACNA HVAC Duct Construction Standard, unless a higher pressure class and/or seal class is required by actual, system operating conditions. Ductwork in unconditioned spaces shall be constructed for a 2-inch static pressure construction class with seal class C, unless a higher-pressure class and/or seal class is required by actual, system operating conditions. All duct seams and joints shall be sealed using duct mastic. Tape shall not be used as a means for sealing ductwork.
- c) Provide a minimum of 2-inch thick mineral fiber insulation (or other listed insulation with an equivalent R-value) on the exterior of exhaust, supply, return ducts in unconditioned spaces. Insulation shall be faced with a vapor barrier material having a performance rating not to exceed 1.0 perm. Insulation, vapor barrier, and closure systems shall be non-combustible as defined in NFPA 255, with a flame-spread rating of not more than 25, and a smoke development rating of not more than 50, as defined in ASTM E-84.
- d) Return air ductwork shall be sized for a maximum velocity of 900 fpm.

### 13.4.4 FILTRATION

Provide a pleated 1-inch panel filter, sized for and installed in the return air system in accordance with UL 900. Filter shall be easily accessible to the occupants. Filter shall be rated for 20 percent efficiency as determined by ASHRAE 52; Method of Testing Air Cleaning Devices used in General Ventilation for Removing Particulate Matter. All filters shall be easily accessible for changing and maintenance. Kitchen exhaust hoods shall be provided with aluminum grease filters sized to fit the exhaust duct.

### 13.5 THERMOSTATS

Thermostats shall be located on interior partitions, approximately 5 feet above the finished floor. Locating a thermostat, on an exterior wall or where it is subject to unrepresentative temperatures is unacceptable. Thermostat shall be electromechanical, non-programmable with adjustable temperature range stops. Honeywell T87F1826 with Q539 thermostat sub-base, or equal, is an acceptable device.

### 13.6 EXHAUST FANS

Exhaust fans shall be provided in all baths, toilet rooms, and kitchens. Bathroom and kitchen range hood exhaust fans shall be ducted to the outside. All exhaust fans shall be ducted to the outside. Fans ducted to the roof shall exhaust on the back slope of the roof, not visible from the front of the house or street. Fans shall be tested and rated in accordance with AMCA 210, or HVI, and shall operate with 120-volt, single-phase power supply. Each fan shall have a removable front grille and be controlled by a dedicated wall switch. Exhaust fans shall be provided with backdraft damper. Bathroom exhaust fans are required, even if an operable window is provided, and shall be ceiling mounted and shall be sized to provide not less than 10 air changes per hour in the space served. These exhaust fans shall be switched separately from light switches. Maximum allowable noise level for bathroom exhaust fans shall be 4 sones as installed. Kitchen range exhaust fans shall be two-speed, and shall be sized for an exhaust rate of 1.5 cfm/ ft<sup>2</sup>. Maximum allowable noise level for range hood exhaust fans shall be 6 sones as installed. Where exhaust fans are ducted through the attic to the roof, they shall extend above the roof per code and be provided with a weatherproof cap. {AM#0005} \_\_\_\_\_. Plastic or flexible metal ductwork shall not be used.

### **13.7 DRYER VENTS**

A 4-inch diameter dryer vent shall discharge to the exterior with weatherproof wall jack and backdraft damper, and provide connection to occupant-owned dryer (one dryer per vent). The vents shall be rigid aluminum with exterior wall cap and backdraft damper. Vent pipes shall be a maximum of 20 feet long, with no more than three right angle elbows (with minimum radius of 6 inches), and have a maximum vertical run of 12 feet. Dryer vents shall not exhaust near the air conditioning condensing unit, windows, balconies, main entry doors, sidewalks, patio, or garage door. Dryer vents to vent through an exterior wall and not be visible from the street and shall not run through non-accessible spaces, roof, attics or garages.

### **13.8 PIPING REQUIREMENTS**

Air conditioner condensate drains, refrigerant suction, and exterior refrigerant liquid lines shall be insulated with a minimum of 1 inch thick cellular glass or unicellular foam pipe insulation. Exterior refrigerant line insulation shall be encased in either an aluminum or PVC jacket to prevent damage. Condensate lines shall be one size larger than the drain pan connection, be properly trapped, and not directly connected to a sanitary sewer system. An air gap fitting is required.

### **13.9 ATTIC VENTILATORS**

Contractor shall provide thermostatic fan powered ventilator within attic of each housing unit. Ventilators shall be low-profile type, and shall be sized to ventilate the attic space at a minimum rate of 0.6 cfm/ft<sup>2</sup>. The Contractor shall coordinate the inlet and outlet areas available for attic ventilation with the architect to insure proper fan performance. Roof penetration for ventilators shall be on the back side of housing units, opposite the street. See PART 9 of this section for ventilator insulation requirements.

### **13.10 ENERGY USE BUDGET (EUB)**

The EUB for each housing unit shall be 55,000 Btu/square foot/yr. The Design Energy Usage (DEU) shall be determined for the housing units and will consist of the computed annual energy usage of the proposed housing unit design based on normal loads for maintaining comfort and amenities for the occupants. The DEU shall be equal to or less than the EUB.

### **13.11 TESTING, ADJUSTING, AND BALANCING**

Adjusting and balancing of each housing unit, meaning 2 bedroom unit or 3 bedroom unit, shall be the Contractor's responsibility. A firm certified for testing by the Associated Air Balance Council (AABC) or

National Environmental Balancing Bureau (NEBB) shall accomplish testing. The selected standard shall be used throughout the project. Instrumentation accuracy shall be in accordance with the standard selected. Prior to testing, adjusting, and balancing, the Contractor shall verify that the systems have been installed and are operating as specified. Where specific systems require special or additional procedures for testing, such procedures shall be in accordance with the standard selected. Approved detailed drawings and all other data required for each system and/or component to be tested shall be made available at the job site during the entire testing effort. Testing shall not commence until approved by the Contracting Officer. The facility shall be essentially complete with final ceiling, walls, windows, doors, and partitions in place. Doors and windows surrounding each area to be balanced shall be closed during testing and balancing operations. Air systems, refrigerant systems, and exhaust fans shall be complete and operable. All data, including deficiencies encountered and corrective action taken, shall be recorded. Following final acceptance of certified reports by the Contracting Officer, the setting of all HVAC adjustment devices shall be permanently marked by the Contractor's balancing engineer so that adjustment can be restored if disturbed at any time. Following adjusting and balancing, testing of air system shall be performed on 10 percent of the project buildings (not to exceed 10 buildings) which have been randomly selected by the Contracting Officer. If buildings are to be turned over in phases, testing shall be performed on 10 percent of the buildings completed in each phase (not to exceed 10 buildings per phase). No additional testing will be required if at least 90 percent of the tested buildings pass the test requirements. If less than 90 percent of the tested buildings pass the test, an additional 10 percent of the project buildings (not to exceed 10 buildings) shall be tested. This process shall continue until 90 percent of the total number of tested buildings pass. The contractor shall correct all housing units not found in compliance, and shall be responsible for all labor and materials required for this effort. AABC MN-1, or NEBB-01 shall be used as the standard for providing testing of air system.